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THE
ANATOMY
OF THE
HUMAN BODY.

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VOL. IV.

CONTAINING THE

ANATOMY OF THE VISCERA OF THE ABDOMEN,
THE PARTS IN THE MALE AND FEMALE PELVIS,
AND THE LYMPHATIC SYSTEM.

PART I.
OF THE ABDOMINAL VISCERA.
INTRODUCTORY VIEW OF THE SYSTEM OF THE VISCERA, AND OF THE STRUCTURE OF GLANDS.
CHAP. I. OF THE STOMACH AND INTESTINES.
CHAP II. OF THE LIVER, SPLEEN, PANCREAS, AND KIDNEY.
PART II.
OF THE MALE PARTS OF GENERATION.
CHAP. I. OF THE PARTS WITHIN THE PELVIS.
CHAP. II. OF THE PARTS CONNECTED WITH THE VISCERA OF THE PELVIS, BUT SITUATED WITHOUT IT.
PART III.
OF THE PARTS OF THE FEMALE PELVIS.
PART IV.
OF THE LYMPHATIC SYSTEM.

WITH AN APPENDIX.

By *CHARLES BELL,*

FELLOW OF THE ROYAL COLLEGE OF SURGEONS OF EDINBURGH.

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1804.

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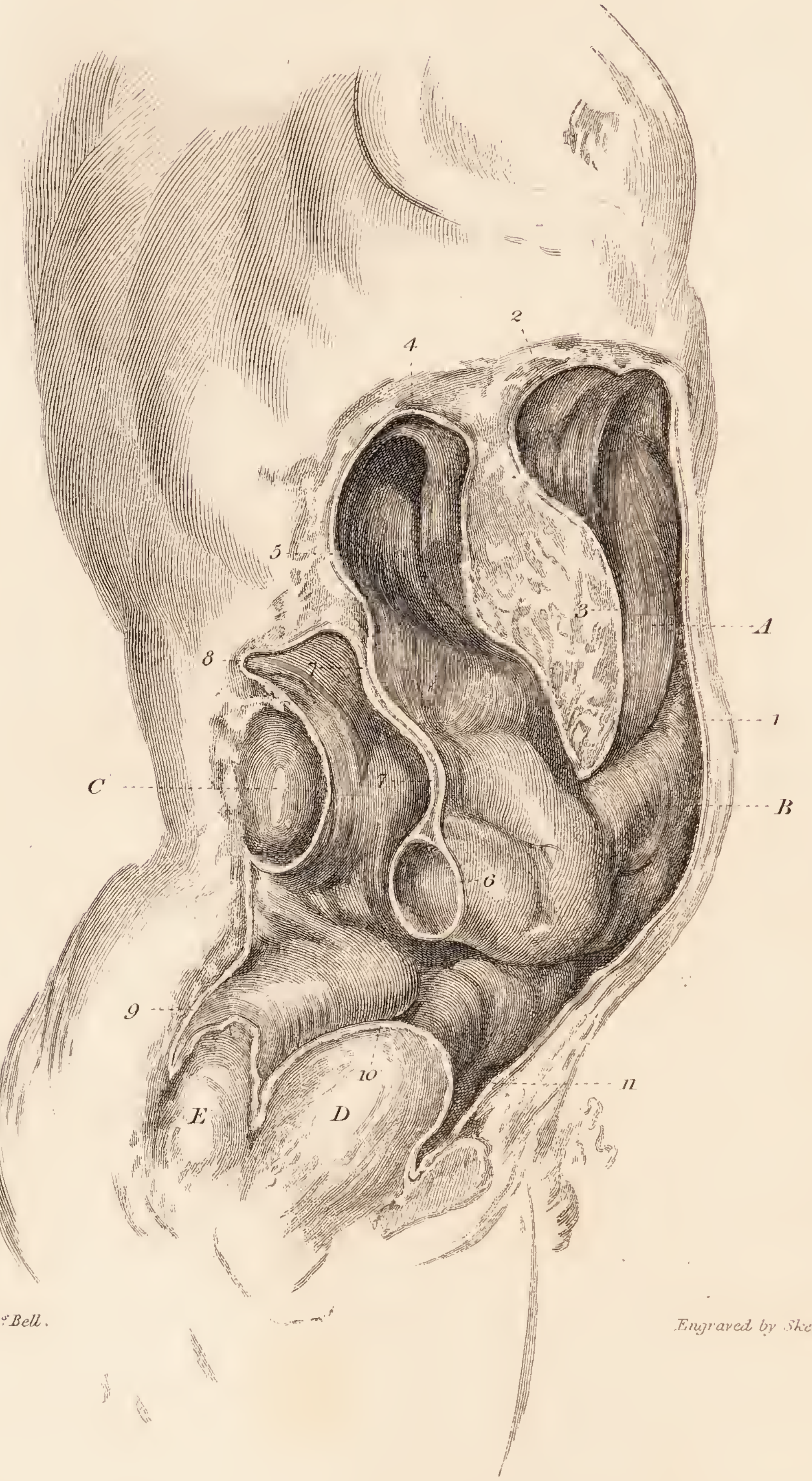

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EXPLANATION

OF THE

PLATES.

PLATE I.

THIS plate repreſents an ideal ſection of the abdomen, and the cut edge of the peritoneum is repreſented by the white line.

A. The LIVER.
B. The INTESTINES.
C. The KIDNEY.
D. The BLADDER of URINE.
E. The RECTUM.

1. The PERITONEUM, where it lines the abdominal muſcles.
2. The PERITONEUM, where it is reflected to form the ligament of the liver.
3. The liver being repreſented cut through, we can trace the lamina of the ligament 2, over its

ſurface 3, forming the peritoneal coat of this viſcus.

4. Marks the PERITONEUM reflected from the liver upon the diaphragm.

5. Here the PERITONEUM is reflected off from the ſpine, to form one of the lamina of the meſentery.

6. The peritoneal coat of the inteſtine, which we can trace round the circle of the gut until it unites again with the meſentery.

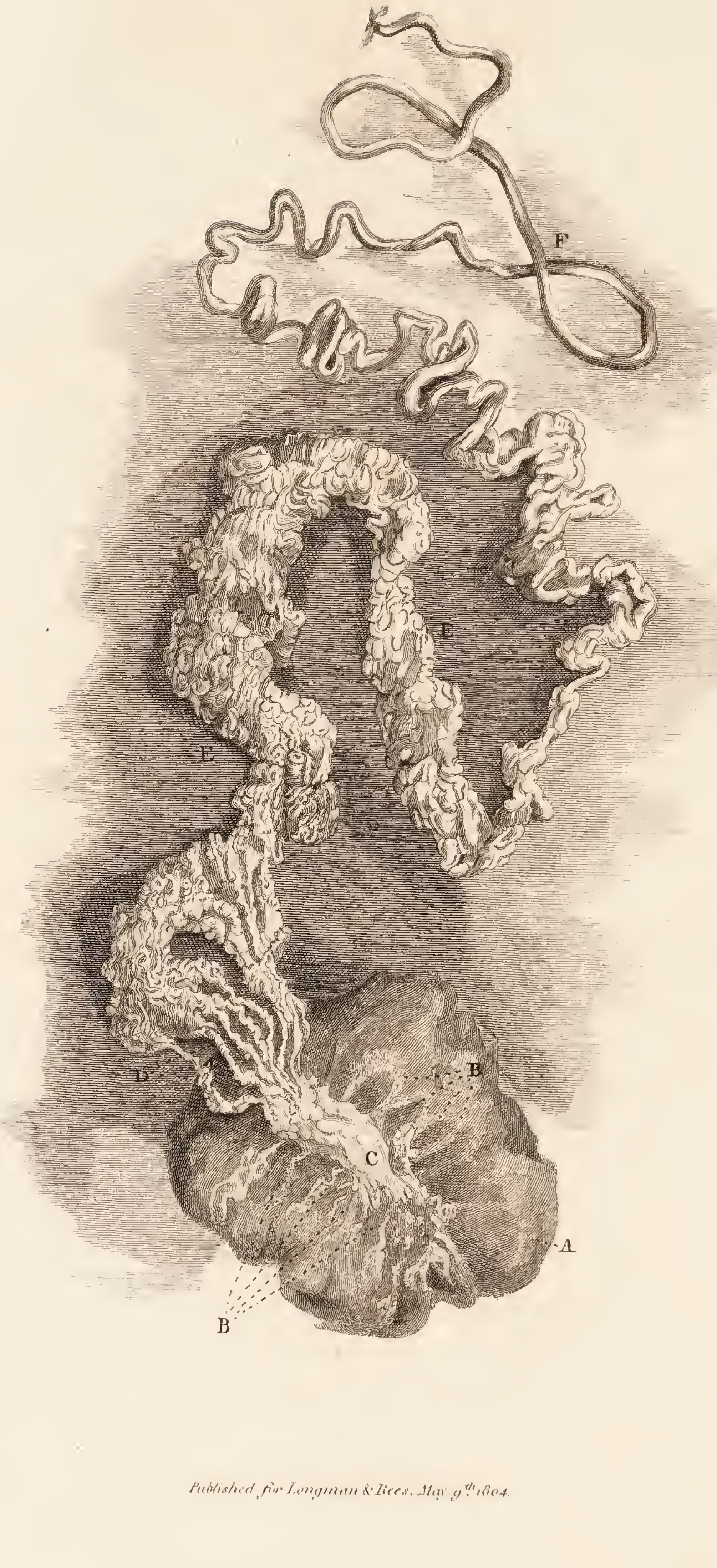
7. 7. The PERITONEUM, forming the lower lamina of the meſentery.

8. The PERITONEUM at that part where it is reflected, and covers the kidney.

9. The PERITONEUM is here deſcending upon the rectum E, we ſee it reflected over the gut, and deſcending again betwixt the rectum and bladder.

10. The PERITONEUM where it forms a coat to the fundus of the bladder.

11. At this part we ſee the peritoneum reflected up upon the os pubis, and from that we trace it to fig. 1. Thus we ſee, that the peritoneum can be traced round all its various inflections and proceſſes; which ſhews, that it forms one continuous ſac, and that the inteſtines and the liver are equally on the outſide of this membrane with the kidney.



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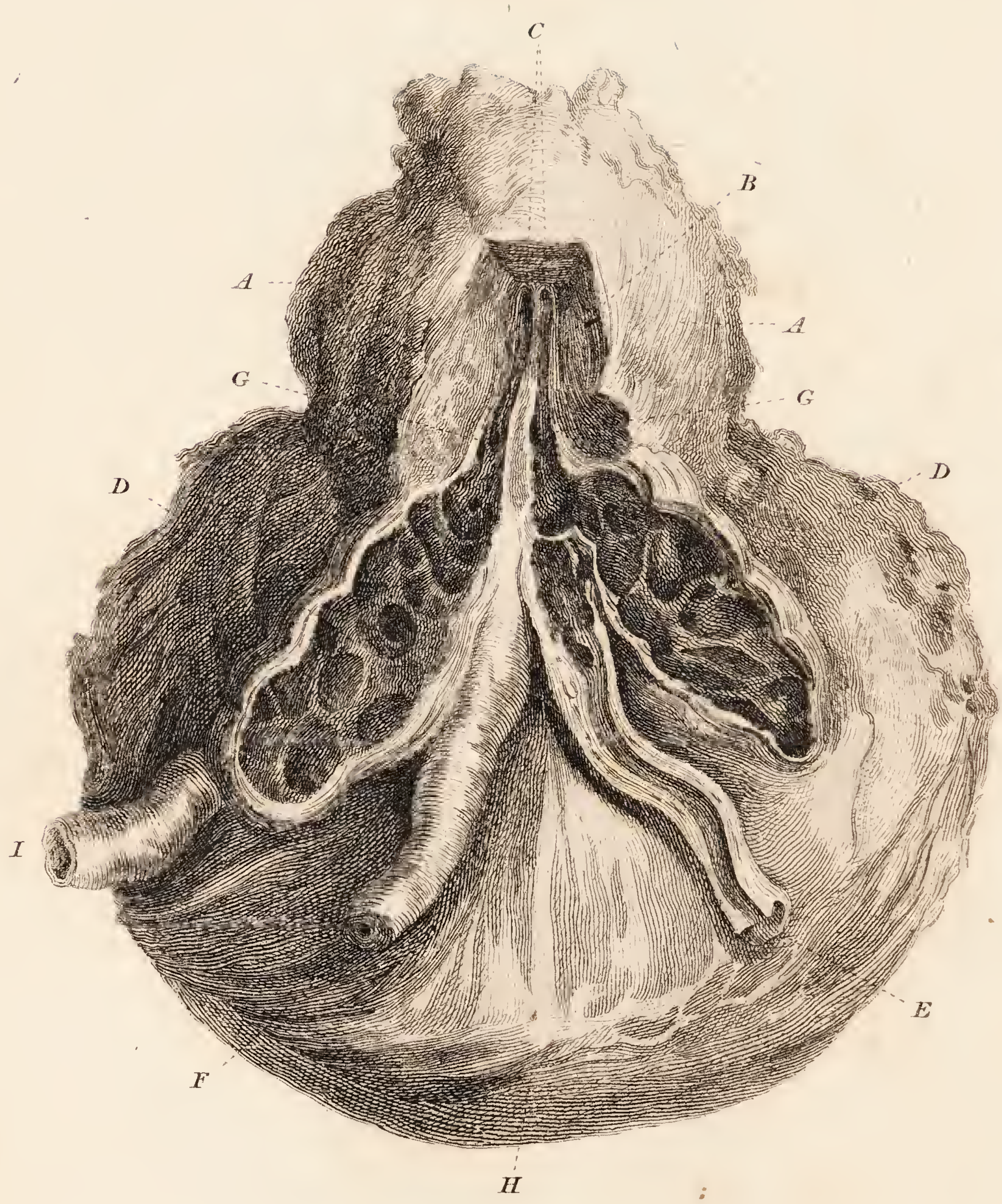

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Explanation of Plate II.

This Plate repreſents the epididimis and teſticle, injected with quickſilver, and diſſected.

A. The body of the teſticle with the tunica albuginea diſſected off.

B. B. The ſeminal veſſels in the body of the teſticle, or TUBULI TESTIS *.

C. The RETE TESTIS formed by the the union of the veſſels B. B.

D. The VASA EFFERENTIA, which as they proceed from the teſticle, are convoluted in a conical figure, and are called the VASCULAR CONES.

E E. The EPIDIDIMIS formed of the union of the vaſcular cones; it is a little diſſected and ſpread out.

F. The vas deferens.

Explanation of Plate III.

This Plate repreſents the proſtate gland, veſiculæ ſeminales, and lower part of the bladder, the parts being previouſly hardened in ſpirits, the veſiculæ were afterwards cut open.

A A. The body of the PROSTATE GLAND; it is that lower part of the gland which can be felt through the rectum.

B. The proſtate gland is here cut into and diſſected, in following the ducts of the veſiculæ.

C. The extremities of the ducts common to the veſiculæ ſeminales and vaſa deferentia.

---

* Where the tubuli are emerging to form the rete vaſculoſum, or rete teſtis, they are called the *vaſa recta.*

D D. The

D D. The cells of the veſiculæ ſeminales, which are laid open by a ſection.

E The left VAS DEFERENS, which is alſo laid open to ſhew the cellular ſtructure which it aſſumes towards its termination

F. The RIGHT VAS DEFERENS.

G G. The foramina, by which the vaſa deferentia open into the common duct.

H. The lower and back part of the BLADDER.

I. The RIGHT URETER.

EXPLANATION OF PLATE IV.

This plate repreſents a ſection of the neck of the bladder.

A. The lower part of the urinary bladder near the neck.

B. The opening of the right ureter, which is marked I. fig. iii.

C C. The ſubſtance of the proſtate gland, which is cut through; its thickneſs, texture, and the manner in which it ſurrounds the beginning of the urethra, will be underſtood from this plate.

D. The URETHRA laid open.

F. The VERUMONTANUM, OR CAPUT GALINAGINIS.

G G. The points of feathers put into the openings of the veſiculæ ſeminales and vaſa deferentia.

N. B. Round theſe ducts, on the ſurface of the verumontanum, and in that part of the urethra which is ſurrounded by the proſtate gland, innumerable mucous ducts may be obſerved: into ſome of theſe ſmall briſtles are introduced.

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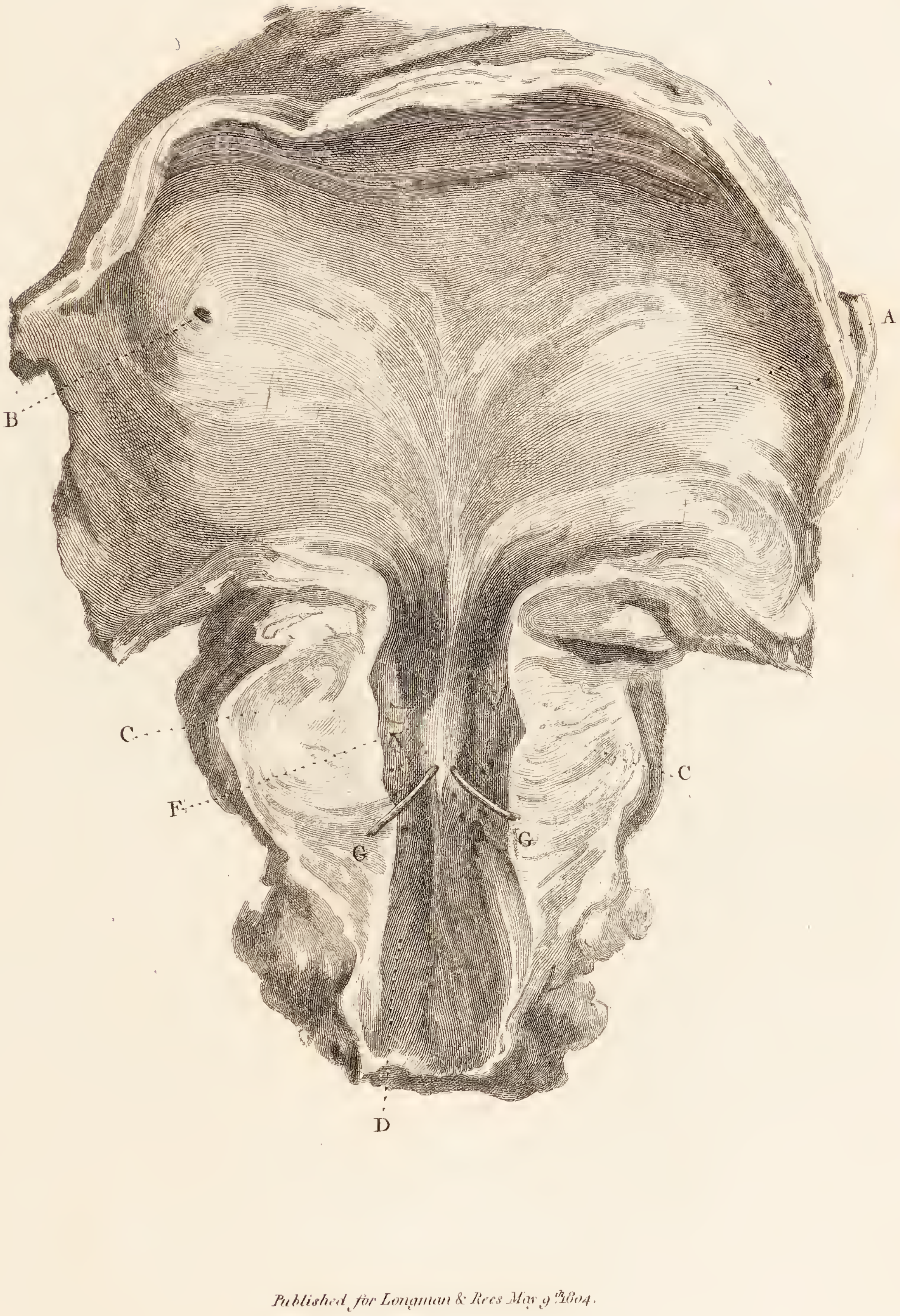

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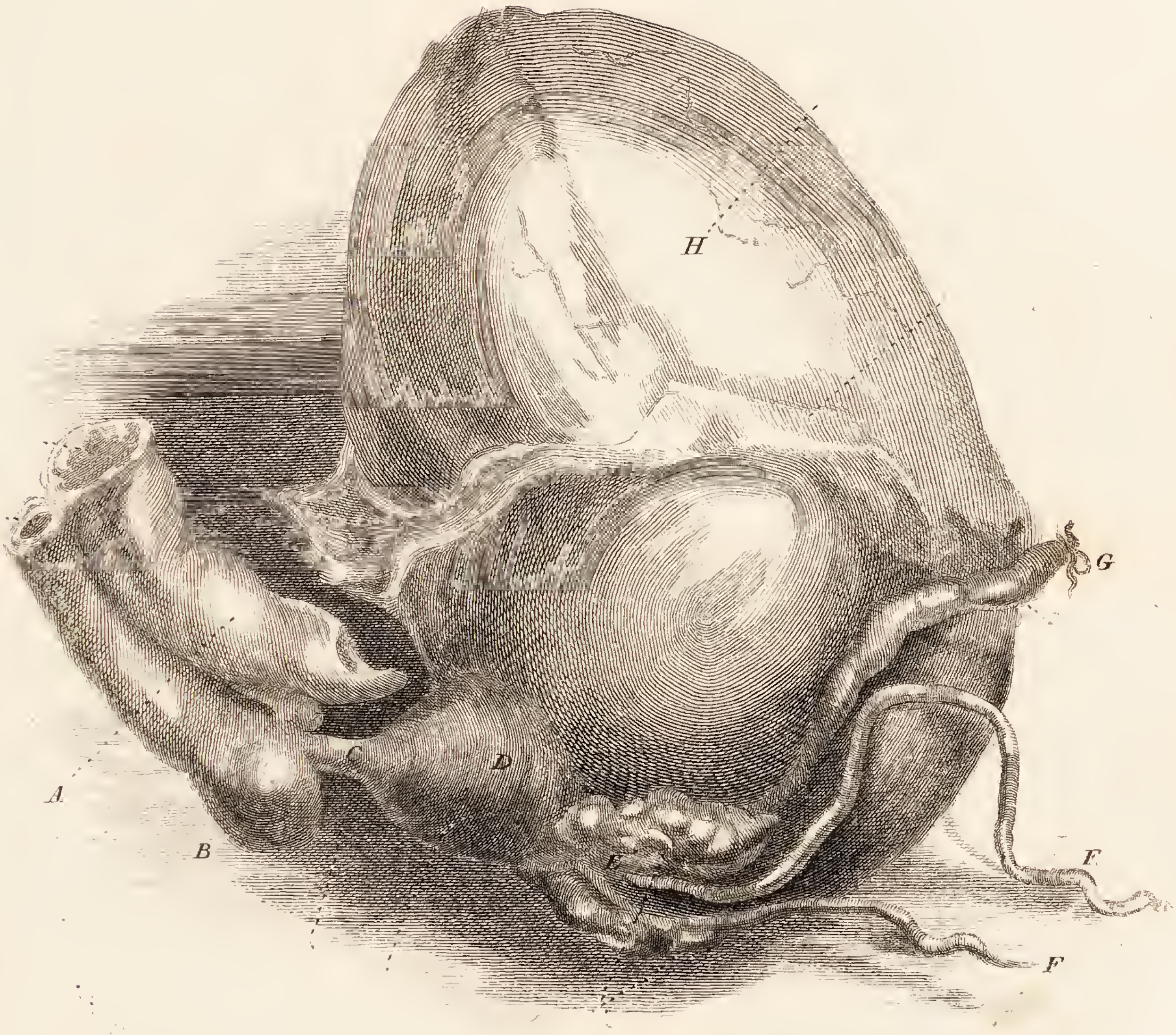
Plate V. Vol. IV.



A. Crus penis.

B. Bulb of the Urethra.

C. Membranous p.t of the Urethra.

D. Prostate Gland.

E. Vesiculæ Semin.

F.F. Vasa deferentia.

G. The Ureter.

H. Bladder covered by the Peritoneum.

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Plate

Fig. 1.

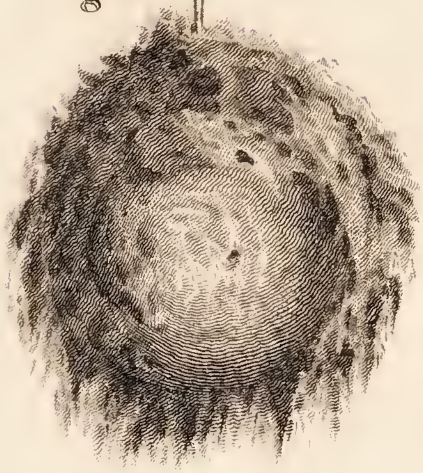


Fig. 2.

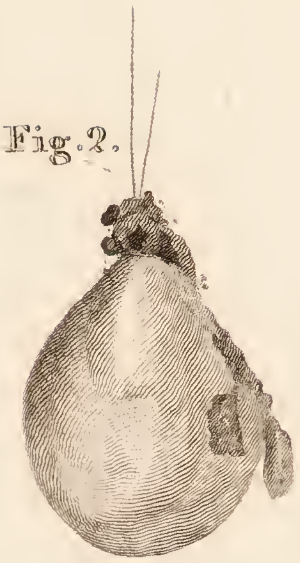
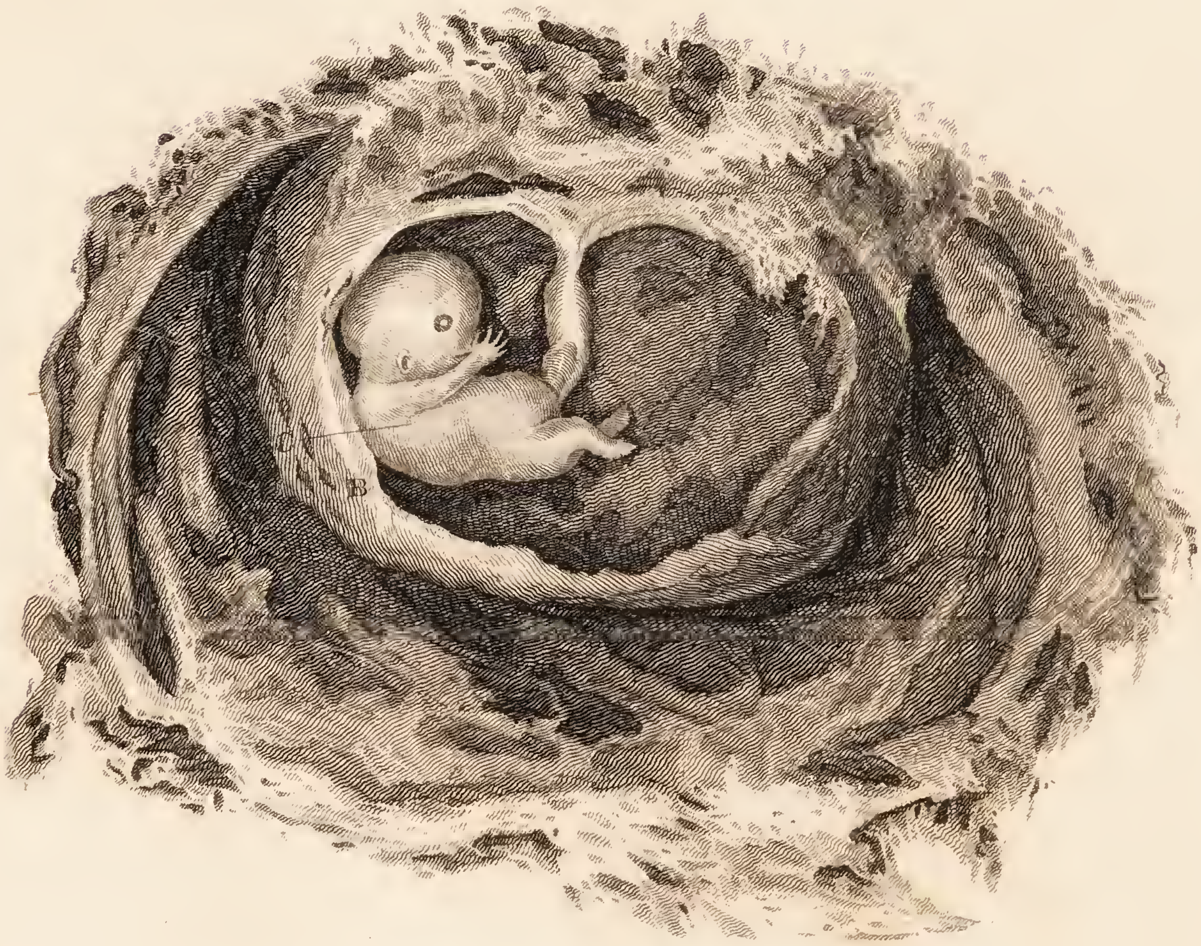


Fig. 3.



Chas Bell delt

D. Lizars

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EXPLANATION

OF THE

PLATES.

PLATE VI.

Fig. 1.

An ovum in a very early ſtage, repreſenting the ſhaggy ſurface of the true chorion.

Fig. 2.

We may ſee here the fœtus in a very early ſtage contained in the tranſparent amnion, and, attached to the outſide of the amnion, the VESICULA UMBILICALIS.

N. B. Theſe are not repreſentations of the ſame abortion.

Fig. 3.

Repreſents the ovum a little more advanced.

A. The CHORION.

B. The AMNION.

C. The FOETUS hung by the UMBILICAL CHORD.

EXPLANATION OF PLATE VII.

This plate repreſents two views of a conception, we ſhall ſay about the end of the firſt month, and here the decidua and the ovum have been thrown off together. This abortion was prepared ſo as to reſemble the beautiful engravings in Dr. Hunter's xxxiv table.

FIG. I.

The deciduous efflorefcence formed by the womb is ſeen here intire, and ſeen as if moulded to the cavity of the womb: it is only neceſſary to obſerve that it hung inverted.

A. The lower part of the conception, which was near the neck of the womb, and which has ſome coagula of blood attached to it.

B. B. Quills introduced within the decidua by an opening near the neck of the womb, and their points brought out at that part of the membrane which anſwers to the opening of the Fallopean tubes: there it is either entirely deficient, or it is ſo thin that it has been torn at C. C.

FIG. 2.

Here the other ſide of the conception is ſhewn, and the ovum is ſeen to have adhered to the outer ſurface of the decidua.

AA. AA. The quills introduced into the cavity of the decidua.

B. The ſhaggy ſurface of the decidua.

C. C. The fleecy outer ſurface of the chorion.

Plate VII.

Fig. 1.

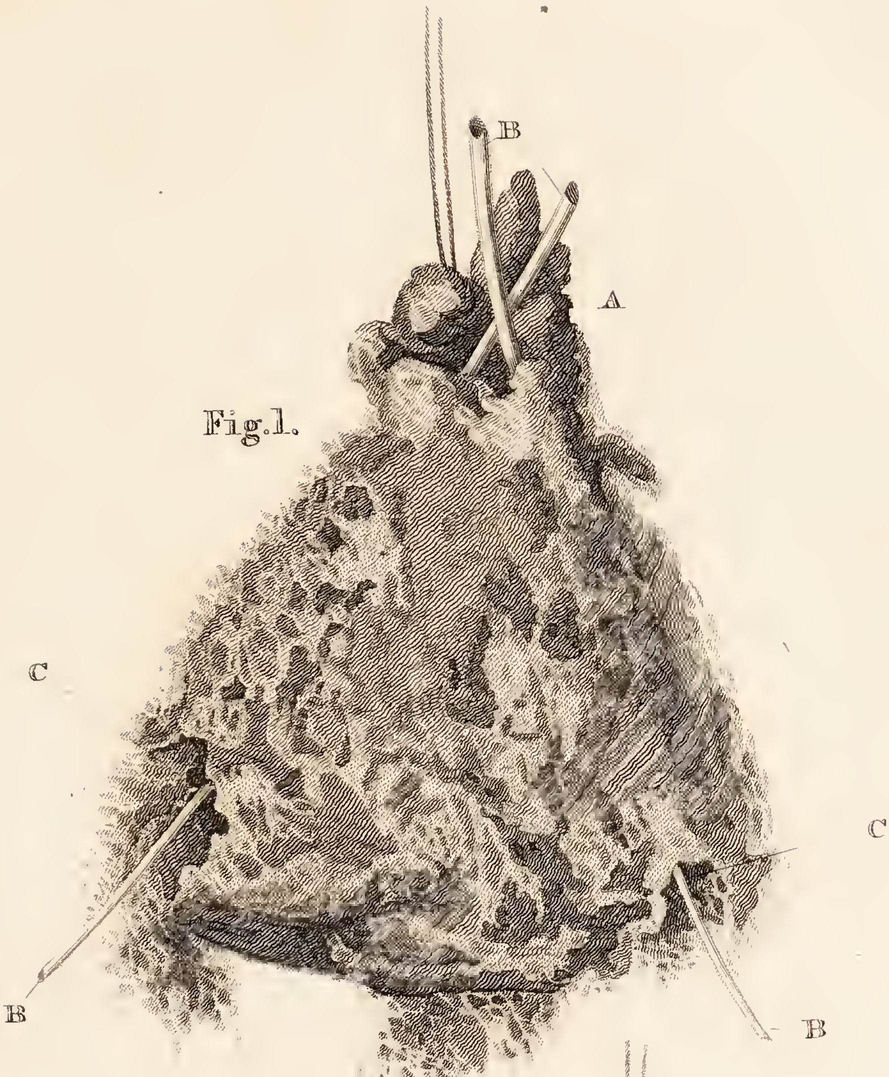

Fig. 2.

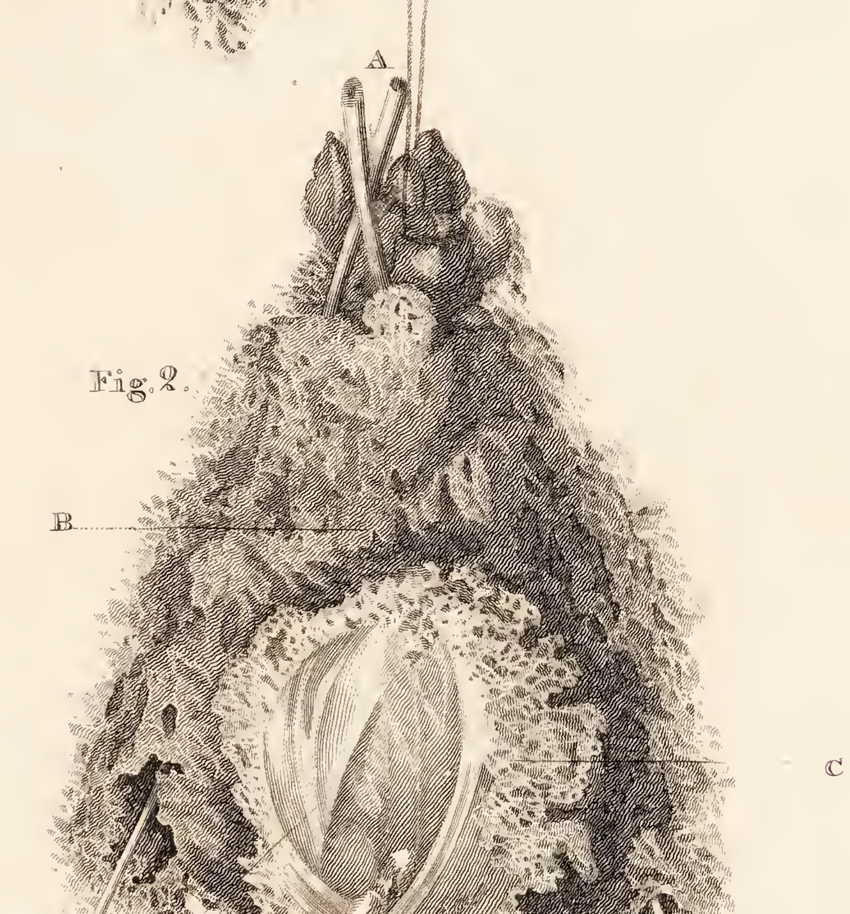

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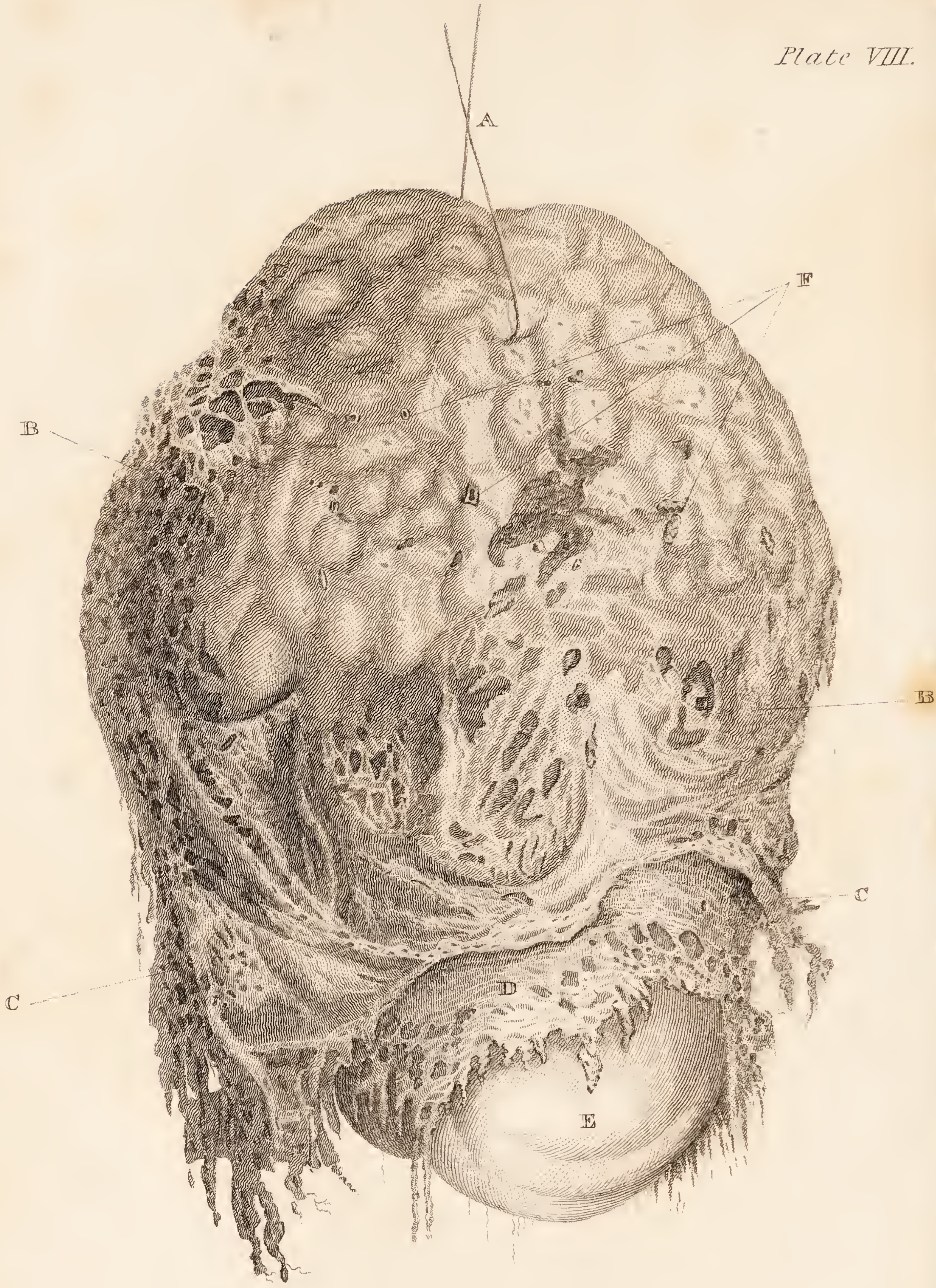
Plate VIII.



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It is here to be obſerved that the ovum, C D E. may be ſuppoſed to be as it has deſcended from the ovarium, only ſomewhat enlarged, and it is here evidently on the outſide of the decidua, but it has been torn open, and that deciduous ſurface which connected it to the ſurface of the womb at this place has been left with the womb, to be afterwards thrown off with the diſcharges.

D. The delicate membrane the amnios.

E. The umbilical cord, and part of the fœtus.

EXPLANATION OF PLATE VIII.

This and the following plate repreſents a conception of the third month, and as the abortion was thrown off very intire, we have another opportunity of obſerving the ſtate of the decidua in a more advanced ſtate.

A. A thread paſſed through the more ſolid placentary maſs ſuſpending the whole.

B. B. The DECIDUA, having a peculiar reticulated appearance.

C. C. Shreads of the DECIDUA, where it has burſt in the delivery.

D. The DECIDUA REFLEXA, through which alſo the proper membranes have burſt.

E. The TRUE CHORION.

F. Very ſmall curling arteries which are entering the decidua, or what may be conſidered as the maternal portion of the placenta.

EXPLA-

EXPLANATION OF PLATE IX.

We have here preſented a view of a ſection of the ſame conception.

A. The DECIDUA.

B. B. The cut edge of the DECIDUA, which will be ſeen to ſurround the whole ovum, and particularly it may be obſerved to form on the upper part a diſtinct lamina from the placenta F.

C. C. The DECIDUA.

D. The DECIDUA REFLEXA.

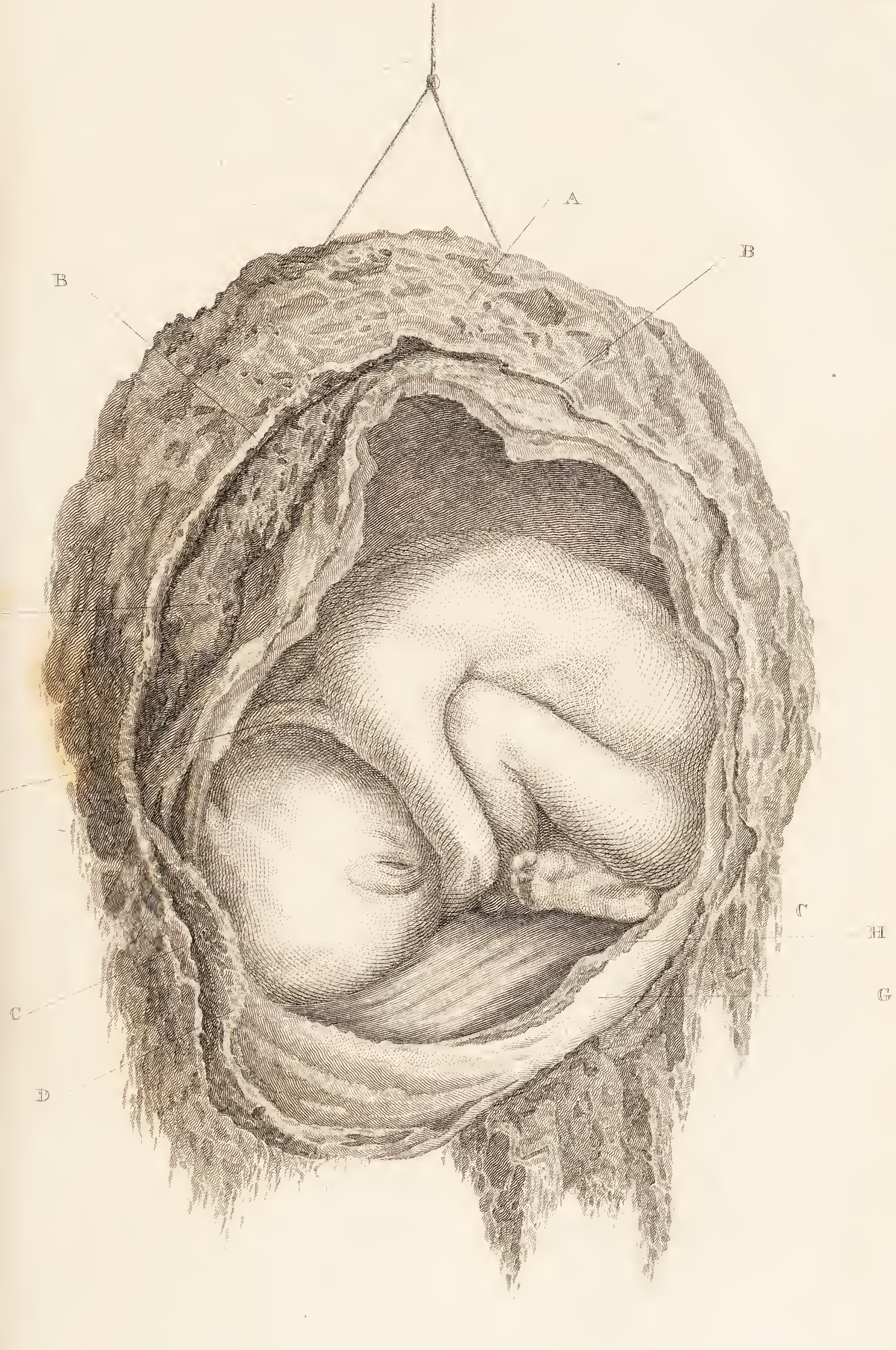
F. The PLACENTA already formed by the accumulated veſſels of the chorion.

G. The CHORION towards the lower part of the womb; here, it may be obſerved the fleecy veſſels have diſappeared.

H. The AMNION.

I. The umbilical cord twiſted three times around the neck of the fœtus.

Plate IX.



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PART THE FIRST.

OF THE ABDOMINAL VISCERA.

INTRODUCTION.

VIEW OF THE SYSTEM OF THE VISCERA, AND OF THE STRUCTURE OF GLANDS.

In this laſt volume we have to comprehend the anatomy and functions of the ſeveral viſcera of the abdomen and pelvis, conſidered not only as individual parts, but as connected together and as forming with the lymphatic and circulating ſyſtems of veſſels a great part of that chain of mutual dependance and relation which conſtitutes the animal œconomy a whole. It becomes neceſſary therefore to take here a ſlight and curſory view of the œconomy of the inteſtinal canal and abſorbing ſyſtem, including at the ſame time ſomething of the hiſtory of opinions regarding ſecretion and the ſtructure of glands. It will be underſtood, that theſe introductory obſervations are meant only to combine the ſeveral parts, and to prevent that manner of deſcription, which is neceſſary to accuracy and minuteneſs, from leading us to conſider the ſeveral parts as diſtinct and inſulated.

An animal body is never for a moment ſtationary: the remoteſt part is in action, and every point is ſuffering a perpetual change. From the firſt moment of our exiſtence we have commenced a revolution: we, by ſlow degrees, advance in activity and ſtrength, and ripen to maturity; but by as ſlow and as ſure gradations we decline to feebleneſs and infirmities: and the more rapidly that animals advance in the firſt ſtage of their progreſs, ſo is the proportion of their decline.

But it is not in obſerving the changes of the animal body from youth to age that the operations of the œconomy are the moſt intereſting. It is when we find the living body to conſiſt of parts performing a variety of functions, and theſe connected and mutually dependant; when we ſee the circulating fluid throwing out fluid and ſolid ſecretions to build up and ſupport the body, which is in inceſſant and daily decay. Again, our admiration is ſtrongly excited when we obſerve the ſyſtem to conſiſt of fluids and ſolids, and the exiſtence of the animal to depend upon the balance of their power; the fluids ſeparating and combining in new affinities, and forming the various ſecretions; and the ſolids having action, and that action controlling the affinities and new combinations of the circulating fluids. We find that life ſubſiſts by the due action of ſolids and fluids; or that an incomprehenſible influence in a living body is exerted on the latter, and that the chemiſt can never ſo combine the fluids out of the body as to imitate the changes produced in a living ſyſtem of fluids and veſſels. Forgetting that animation is the eſſential character of living bodies, phyſiologiſts have too much endeavoured in every age to explain the phenomena of animated nature by illuſtrations drawn from mechanics, chemiſtry, or hydraulics.

In a body in which there is life there is a perpetual waſte; firſt by ſecretions, which for particular purpoſes are thrown into the cavities, and afterwards carried out of the body entirely by the excretions of the kidney, the perſpiration by the ſurface, the exhalation by the lungs, the ſecretions of the internal cavities as of the inteſtines. But more than this, there is a decompoſition of the ſolids of the body which are carried into the circulating fluids, and finally diſmiſſed from the ſyſtem. Laſtly, we cannot but obſerve, that even the powers of muſcular motion, nay, the powers of the mind and of the ſenſes, are exhauſted by exerciſe, and renovated through the influence of the circulation. The continued action of a muſcle is followed by feebleneſs and the continued impreſſion of the rays of light exhauſts the retina, ſo that the object becomes firſt faint and then vaniſhes.

Since there is waſte of the ſolids and fluids, and exhauſtion of the energies of the ſyſtem, ſo alſo muſt there be a ſource of ſupply, and means of renovating its action. Accordingly animals have appetites requiring the ſupply of food, and the call of hunger is controlled by the neceſſities of their ſyſtem. When food is received into the firſt paſſages, there is thrown out from the ſtomach a fluid which diſſolves it, changes its properties, and is itſelf eſſentially altered. The work of aſſimilation is thus begun. As this converted fluid takes its courſe through the inteſtines, it is more and more changed; more aſſimilated to the nature of the peculiar fluids of the animal; and having ſtill additional ſecretions united to it, particularly the bile, it is by theſe means ſeparated from the groſſer parts of the aliment. This fluid, which is now called chyle, is abſorbed by a particular and appropriate ſyſtem of veſſels, which, from their conveying this white and milky-like fluid, are called the lacteals. The lacteal veſſels carry the chyle to the thoracic duct, the trunk of the abſorbing ſyſtem; but not directly; for the chyle is depoſited in the meſenteric glands, from which it is again abſorbed and carried forward. Or if we ſuppoſe theſe glands to be merely convoluted veſſels, its flow is at leaſt delayed, ſo that it is not at once thrown into the maſs of circulating fluids.

We find then that the ſtomach performs digeſtion, and the ſpleen, we will venture to affirm, is ſubſervient to it. The ſecretion of the liver we find to prepare the chyle for abſorption, while at the ſame time it is the peculiar ſtimulus to the inteſtines. The pancreas pours out a fluid which tempers the acrid bile. The ſuperior part of the inteſtinal canal abſorbs the nutritious fluid or chyle, while the groſs remains of the food move on to be depoſited in the great inteſtines. The great inteſtines are not only receptacles, but form at the ſame time an extenſive ſecreting ſurface uſeful in the œconomy, by throwing off the waſte of the ſyſtem.

The lacteal veſſels, which take up the chyle, are but branches of the ſyſtem of abſorbents—which is a ſyſtem conſiſting of two great diviſions, the lacteals and lymphatics: the firſt receiving the nutritious fluids from the inteſtinal canal, and the latter being abſorbents, taking up the fluids which have been thrown out upon the cavities and ſurfaces of the body; and we preſume upon the ſolid parts of the body alſo. Thus the new fluids, rich in ſupplies, are mingled with thoſe which are fraught with the waſte and decompoſition of the ſyſtem. The thoracic duct, the trunk of this ſyſtem, conveys theſe fluids thus mingled together into the right ſide of the heart, where they are received into the vortex of the circulating red blood. Theſe fluids, now agitated and wrought up with the blood in the cavities of the heart, are ſent through the circulation of the lungs, and ſubmitted to the influence of their action and the expoſure to the atmoſpheric air.

When chyle is formed in the ſtomach and inteſtines, it is obſerved to conſiſt of albumen, ſerum, globules, and ſalts: but the change which it may undergo by its reception into the lacteals, its being depoſited in their glands, its mingling with the lymph, its agitation in the heart, have not been obſerved, though it is natural to ſuppoſe that by degrees it aſſimilates in its nature to that of the circulating blood, and does at laſt become perfectly ſimilar by the operation of the lungs.

By the expoſure of the circulating fluids to the atmoſphere in the lungs a gas is abſorbed, which becomes an active principle in the blood, and from the blood is communicated to the ſolids.

That the blood of an animal has properties which diſtinguiſh it from mere matter we readily allow; but to ſay that it poſſeſſes life is to uſe a term in which few will acquieſce. It poſſeſſes properties while circulating in the veſſels diſtinct from thoſe which it ſhews out of the body; and theſe do not depend on the agitation and inceſſant motion, nor on the degree of heat, nor on any ſimilar circumſtance, but apparently on ſome ſecret influence which the veſſels exert over it. The analyſis of the blood by the chemiſts holds out to us little hope of advancing in the knowledge of the œconomy of a living animal. Chemiſtry, when applied to the analyſis of animal matter, leaves its devotees in a perplexity of knowledge and diſcoveries which have no end, and which point to no concluſion.

There are produced from the blood a variety of fluids by organs which are called glands, and the formation or ſeparation of theſe fluids is ſecretion. But the ſolid parts of the body ought to be conſidered as ſecretions equally with the matter which flows from the ducts of glands. For there is formed and depoſited from the blood, during the round of its circulation, bone to ſupport the incumbent weight of the body; muſcular fibre, to give it motion; as well as all the other variety of ſolids and fluids. The only difference betwixt theſe ſolid depoſitions from the blood and the glandular ſecretions is, that the former are ſtill within the influence of the vaſcular ſyſtem, and that they are decompoſed and re-abſorbed, conveyed again into the maſs of circulating fluids before they can be finally expelled from the body.

The chemiſts have obſerved the diviſion of animal bodies into ſolids and fluids, but the ſubdiviſions of theſe are very inaccurate. The fluids they have diſtinguiſhed into three claſſes; 1ſt, Recrementitious humours, which go to nouriſh and ſupport the body; 2dly, The excrementitious fluids, which are carried out of the body by certain emunctuaries; and the 3d are of a compound nature, being partly recrementitious and partly excrementitious. We muſt obſerve, however, that the fluids enumerated under theſe heads ſhew it to be a very incorrect arrangement. The *firſt* diviſion comprehends the fat, the marrow, the matter of internal perſpiration, and the oſſeous juice. The *ſecond* comprehends the fluids of inſenſible tranſpiration, the ſweat, mucus, cerumen, urine, fœces. And the *laſt* diviſion comprehends the ſaliva, the tears, the bile, the pancreatic juice, the gaſtric and the inteſtinal juice, the milk, and the ſeminal fluid. To attend to their arrangements of the ſolid parts of animals would be equally far from ſerving any uſeful end; for they have thrown together parts ſo diſcordant in function and ſo unlike in ſtructure that they can be of no uſe in a general view of the œconomy, and cannot in chemical analyſis ſhew a uniform reſult *.

Perhaps all the correctneſs to which we can at preſent pretend is ſome ſuch diviſion as this. Beſides forming the ſolid maſs of the animal body, theſe ſecretions are drawn from the blood: fluids which are ſubſervient to the aſſimilating of new matter to the ſyſtem; fluids which are uſeful in preſerving the mobility of parts; and, laſtly, the ſecretions which convey away the waſte and debris of the body, which is ſucceſſively replaced by the appoſition of new matter.

From this ſhort view of the ſyſtem we underſtand how inceſſantly the powers are ſpent in action, and the fluids exhauſted by depoſition and ſecretion, and how eſſential to life the functions of thoſe parts are which act upon and aſſimilate the food. It is the conſideration of theſe parts which forms the ſubject of the firſt ſection of the preſent volume. As in the conſideration of theſe functions the ſtructure of the glandular organs becomes a chief ſubject of inquiry, it will be natural at preſent to conſider in a general way the opinions which have been entertained regarding the ſtructure of glands.

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* See Fourcroy's Analyſis of Animal Subſtances.

The peculiar nature of that organization by which the ſeveral ſecretions are formed, has hitherto eluded abſolute proof by experiment or diſſection. It is imagined that there are ſome organs which do little more than ſeparate the parts of the blood like to the exudation by exhaling arteries. But neither in the exhalent arteries nor in the ſimpler organs can I imagine a ſimple ſtraining of the blood, but rather that the ſame principle influences all, and that the ſeveral varieties of ſecretion depend upon a modification of the action. It would appear that the fluids in circulation and the veſſels containing them muſt reciprocally affect each other: we know that a change on the ſtate of the circulating fluids will alter the nature of the glandular action, and an excitement of the gland will ſtill more powerfully change the nature of the ſecretion; the active power of the ſolids appearing to be an agent which controls and directs the chemical affinities.

We are ſtruck with the variety of form in the ſecreting organs. We ſee a ſimple ſurface pouring out its fluids; or a ſimple canal into which the arteries throw out the ſecretion. We find again the ſecreting veſſels and their ducts convoluted and maſſed together forming proper glandular bodies; of which kind are the ſolid abdominal viſcera.

When we diſſect the glands we do not find them to have a ſimilarity in ſtructure. Thus the ſubſtance of the liver, the kidney, the teſticle, &c. are quite unlike, and as their ſecretions are different ſo are their ſympathies: the effect of diſeaſe upon them, and the conſequences of medicine operating through the general circulation will be to attach to one individually, leaving the others in their accuſtomed action. Glands are different not only in their outward form, their general appearance when cut into, and the manner of the connection of their parts, but alſo in a remarkable manner in the length, ſize, and form of their veſſels and ducts.

In conſidering the opinions of phyſiologiſts or anatomiſts regarding glandular ſecretion, and the ſtructure of glands, we find in the firſt inſtance that the old phyſicians contented themſelves with ſaying that the glands or viſcera poſſeſſed a peculiar power to ſelect and ſeparate the fluids from the blood. The next claſs had recourſe to hypotheſis: they ſpoke of the ſeparation of certain parts by means of fermentation *, or by a kind of filtering through the pores or veſſels of glands; that theſe pores allowed only particles of a particular ſize or figure to paſs them †. It was oppoſed to this hypotheſis, that the thinner fluids muſt have run through the organs deſtined for the groſſer ſecretions. But when a theory ſuch as this is received no argument nor proof ſeems neceſſary to overthrow it. Reſting upon authority alone, it ſtood until it was overturned by the faſhion of new doctrines: one equally puerile was raiſed upon its overthrow.

We obſerve, ſays the founder of this theory ‡, that wet or oiled paper will only tranſmit fluid of that kind

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* Van Helmont. Vieuſſens, &c.

† Charleton, Deſcartes, Borelli, Verheyn, &c. &c.

‡ Winſlow. Helvetius.

kind with which it is previouſly imbued, it will not tranſmit the oil when wetted, nor will the water make any impreſſion on the paper when previouſly oiled. Upon theſe facts are to be raiſed a theory of ſecretion! Betwixt the ſecreting veſſels and the ducts, in the peculiar tiſſue of which glandular ſtructure conſiſts, there is interpoſed a fluid of that particular kind which is required to be ſecreted, and when the blood is driven againſt this tiſſue ſo imbued, no fluid but of a nature reſembling that already depoſited can be tranſmitted. By this hypotheſis they explained ſecretion, making it to depend on the attraction and repulſion of the particles of the blood by fluids previouſly ſecreted. We may ſurely leave this claſs of phyſiologiſts accounting for the original depoſitation of the fluids in the glands without a wiſh to ſearch with them into the myſtery of glandular ſecretion. Commentators on this theory, by taking into the ſyſtem the action of the nerves, indicated that they did not altogether forget that the body was alive *.

Another ſet of phyſiologiſts attributed the whole effect of ſecretion to the velocity of the blood in the glands or ſecreting veſſels †; others, to the length and curves of the veſſels, and their action upon the fluids. Again, others have been ſatisfied with the round aſſertion that the vital action was the eſſential cauſe of ſecretion. This, it ought to be underſtood, muſt be univerſally acquieſced in, while yet there may remain an inquiry as to the apparent ſtructure of glands.

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* Conor, Tentamen epiſtolare de Secretione.

† Boerhaave, Pitcarne, &c.

Diſappointed in obtaining an unexceptionable general theory of ſecretion, we are only enabled to conclude, that while a power exiſts in an animal body, directing its actions, perhaps both in the ſolids and fluids, and particularly in the mutual influence which they exert, the form, length, and activity of the veſſels and ducts give occaſion to the greater or leſs degree of intricacy in the operation of the principles upon which the ſecretion depends.

Let us then attend to the obſervations of the ſtrict anatomiſts, and to the appearance which the GLANDULAR VISCERA preſent under the knife.

It is not perfectly clear what the older anatomiſts meant by the expreſſion Parenchyma. It would appear however to have ſaved them the trouble of inveſtigation, and all abſtruſe ſpeculation. They meant fleſh, yet not muſcular ſubſtance, but ſuch as the liver preſents. This matter they ſeem to have conceived to be formed by the blood. Thus Higmore deſcribes the liver to be formed of the blood of the umbilical vein: the opinion originally of Eraſiſtratus.

Previous to the time of Malpighi it is fruitleſs to trace the opinions of anatomiſts regarding the ſtructure of glands. He was the firſt who ſought to throw light upon this obſcure ſubject by anatomical inveſtigation, and he made a more rapid progreſs than has been done by any man ſince his day. If we take into conſideration the difficulties he had to encounter in a new field, and the prejudices of the learned with which he had to combat, his merits will be found greater than even thoſe of Ruyſch. The opinions of Malpighi were received by thoſe who, forſaking the authorities of names, ſaw the importance of the ſtudy of anatomy. Ruyſch himſelf gave credit to the opinions of Malpighi in the early part of his life. But Ruyſch's more attentive obſervations being contradictory to thoſe of Malpighi, his maturer judgment rejected that anatomiſt's proofs, and with a boldneſs in which he was never remarkably deficient he invented a new theory, or at leaſt alleged new facts, and ſwayed men's opinions with an abſolute authority.

Malpighi was an Italian, and born near to Bologna. Whilſt yet a young man, being ſunk under the accumulation of family diſtreſs, abſorbed in grief, and loſt to the conſideration of his intereſt, he received comfort and aſſiſtance from his maſter, who urged him to embrace the medical profeſſion. His progreſs was rapid. After ſtudying at Padua, he was called to fill one of the chairs in Bologna. He was then ſolicited by Ferdinand II., Duke of Tuſcany, to be profeſſor in the univerſity of Piſa. Here he was aſſociated with liberal men: and now only in his ſecond profeſſorſhip did he learn to deſpiſe the ſcholaſtic learning of the time, and betook himſelf to experiment as the only means by which philoſophy could be raiſed from the oppreſſive barbariſm of the ſchools. Malpighi and Borelli were aſſociated; they diſſected together; they ſuggeſted thoughts to each other; they doubted, and canvaſſed freely each other's opinions; and were to each other an excitement and encouragement to perſeverance and induſtry. They were ſupported by government; popular in their teaching; while they collected round them the learned men of the time. This was the origin of the famous Academy del Cimento. Malpighi was, after this, profeſſor in Meſſene, and died in the Quirinal palace at Rome of a ſtroke of the apoplexy *, after having been ſome time phyſician to Pope Innocent XII. Malpighi had many enemies, and even ſome of his colleagues were animated againſt him with a diſhonourable jealouſy. Many laughed at his ſtudies and occupations, as frivolous and abſurd. Something muſt be allowed for men who had laboured with diligence to become learned; for theſe, his opponents, had paſſed their lives in the ſtudy of the Arabian writers. With them ſtudies were enforced which held ſcience in ſubjection; ſtudies which, in place of invigorating, ſerved only to chill and paralyſe exertion, and retard ingenious inveſtigation. Even Borelli, but from other motives, oppoſed and cenſured ſome of the diſſertations of Malpighi.

Malpighi has been conſidered as the inventor of this department of anatomy, which the French, curious in diſtinctions, have called the analytic method. He ſhewed the impropriety of the term Parenchyma, as applied to the ſubſtance of glands. He proved that the lungs, for example, (which they alſo called parenchymatous,) were not fleſhy, and had no reſemblance to the glandular viſcera of the abdomen. He taught, that though glands are ſmooth on their outer ſurface, they conſiſt of lobules connected by cellular membrane: and, upon a ſtill more minute inveſtigation, that they conſiſt of innumerable little folicules or ſacs; that theſe are interpoſed betwixt the arteries which convey

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* Two pounds of coagulated blood were found in the ventricles of his brain by Baglivi.

the fluids and the excretory ducts going out from them; that the arteries, or the vaſa afferentia, after ramifying and encircling theſe bodies, pierce them and ſecrete the particular fluids into them. On other occaſions he deſcribes theſe little glandular bodies as applied to the ramifications of the arteries, like fruit hanging by the branches of a tree.

Malpighi threw in his liquid injections; diſſected and examined with the microſcope; made careful obſervations and experiments on living animals; and laſtly, attended in a particular manner to the phenomena of diſeaſe. By diſeaſe no doubt parts ſwell out and are magnified, and become diſtinct; but it is not a teſt of the natural ſtructure, or implicitly to be truſted to.

Scheme of Malpheghi's opinion.

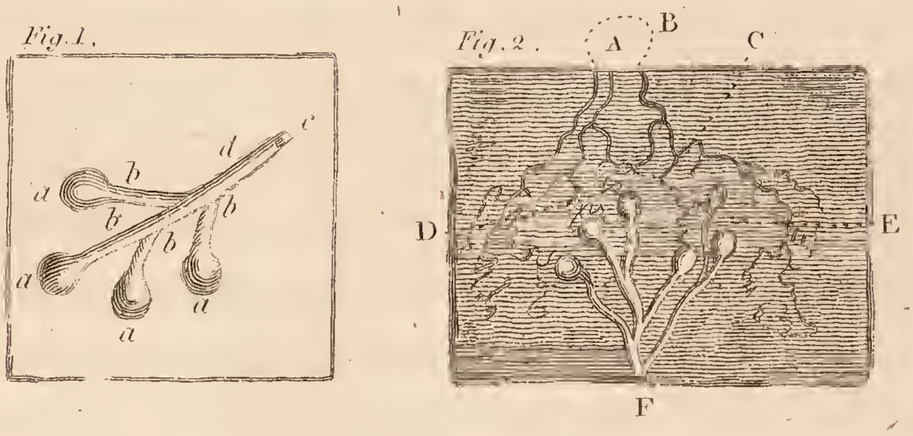


Fig. 1. Boerhaave's plan of Malpighi's doctrine. *a a a* folliculos glandularum ſimpliciſſimarum denotat. *b b b* ſingularia emiſſaria cuique utriculo *a*, propria atque in communem canalem excretorium *d*, *c*,

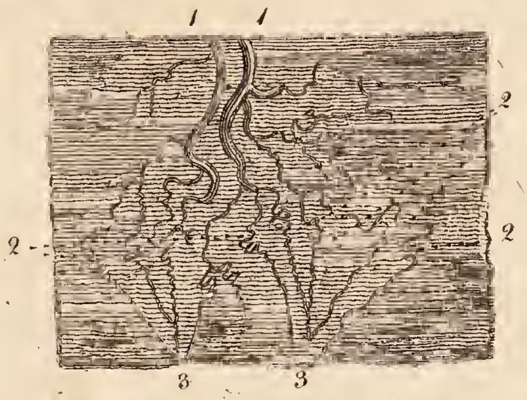
ſuos humores demittentia qui tandem per hujus aperturam *c*, emittantur.

Fig. 2. is a ſcheme farther to elucidate the opinions of Malpighi. A, an artery entering a portion of a viſcus. B, the returning veins. C, the branch of communication betwixt the artery and vein which ſerves to circulate the blood, and convey a part into the veins. D, another diviſion of the artery, which after various playful meanderings terminates in the folicule or little glandular bag E. F, the ducts which receive the ſecreted fluid from the folicules.

Ruysch ſtudied at Leyden under Van Horne, and at a very early age attached himſelf to anatomy and botany. At this time he brought himſelf into notice by a defence of the profeſſors againſt one Bilſius, who, although he was learned and acute, had attacked them with all the weapons of a Charlatan. Returning to his native country, he was raiſed to the profeſſorſhip of anatomy and botany in Amſterdam. It was here that Ruyſch made thoſe diſcoveries in anatomy, and that wonderful and ſudden progreſs in practical anatomy, which not only raiſed him above his cotemporaries, but has been the admiration of all ſince his time. Though new and various methods of preparing the body have been diſcovered ſince the time of Ruyſch, yet there has been no approach to the elegance with which he diſplayed the ſtructure of minute parts. It has been ſaid that, while others preſerved the horrid features of death, Ruyſch preſerved the human body in the ſoftneſs and freſhneſs of life, even to the expreſſion of the features. We muſt no doubt aſcribe ſome part of this encomium to the exaggeration naturally ariſing from the novelty of the thing. But as to his ſuperiority in the manner of diſplaying the minute veſſels of delicate parts, and his methods of preſerving the parts in liquors, tranſparent and ſoft and ſo as to float in their natural folds, there can be no doubt. Neither can the minuteneſs and ſucceſs of his injections be denied: we have too many occaſions in which we muſt reſort to the catalogue of Ruyſch's muſeum for the true anatomy, to doubt his great ſucceſs, or to queſtion the truth of thoſe encomiums which have been beſtowed upon him.

Kings, princes, ambaſſadors, and great generals, but more than theſe, all the learned men of the time, crouded to the muſeum of Ruyſch. We muſt not blame him if, whilſt others were merely ſpeculating about the ſtructure of parts, he, ſurrounded by ſo princely a muſeum, ſhould ſimply have laid open his cabinets, and bid them ſatisfy themſelves whether or not he was right. Ruyſch's preparations went to contradict the opinions of Malpighi. His injections, puſhed more minutely, ſhowed thoſe round bodies which are to be ſeen in ſome of the glandular viſcera (and which Malpighi took to be little bags into which the ſecreted fluid was poured) to be merely convoluted arteries. Ruyſch taught, that the minute arteries after making theſe convolutions terminated in the beginning of excretory ducts; that there was no ſubſtance or apparatus interpoſed, but that the veſſels and ducts were continuous. His opinions being formed upon the ſtrength of more minute preparations, and a ſuperior dexterity of anatomical inveſtigation, few anatomiſts choſe to be outdone, or to acknowledge that they could not ſee what he ſaw. This I believe to be one reaſon of the rapid progreſs of Ruyſch's opinions.

Scheme of Ruysches opinion.



1 1 The ſmaller arteries which do not enter into folicules, but are convoluted. 2 2 The appearance of bodies or bags, but which are merely owing to the convolutions and tortuous figure of the arteries before they terminate in the excretory ducts. 3 3 Excretory ducts or veſſels formed by the continued extreme branches of the arteries *.

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* Ruyſch's doctrine again was thus oppoſed: "Ruyſchius "auget arte ſua replendi extenſionem vaſorum ultra naturalem "magnitudinem. Ruyſchius arte ſua deſtruit glandulas; dein "negat. Ruyſchius negat omnes glandulas. Melius eſt & tutius omnia hæc demonſtrare in cadavere recenti." F. Ruyſch Epiſt. ad Vir. Clar. Her. Boerhaave, p. 50.

It may be farther obſerved, that it was not in the mere fact of there being folicules, in which Malpighi and Ruyſch differed; for the latter conceded that there were hollow membranes, but contended that theſe were not glands. Their difference of opinion is expreſſed in the following words of Ruyſch: "Adeoque diſcrepantia inter magnum illum virum et inter me eſt, quòd ille putat humores delabi in glandulas dictas ſimpliciſſimas,—ibi foveri, mutari: Ego puto, quòd arteriæ ultimæ ſuccos faciant, & factos ibi deponant."

The opinions of Malpighi and Ruyſch have held the ſchools in perpetual controverſy; moſt anatomiſts however leaning to the authority of Ruyſch. There follows theſe a crowd of French academicians, who, with Boerhaave, may be conſidered as mere commentators on the original authorities of Malpighi and Ruyſch. Some of theſe argue for ſecretion by continuous veſſels, and contend that the arteries terminate in the excretory ducts; others, that the ſecretions are made into folicules; and ſome, as Boerhaave, inſiſt that both are right in their obſervations, and in the proofs which they have adduced, that ſecretion is in part performed by continuous veſſels, partly by a more intricate glandular apparatus.

As the forms of the parts which throw out ſecretions have an infinite variety, it may be uſeful in this introductory view to point out theſe varieties, and their appropriate names *. In the firſt place, although in general language the term gland implies a ſecreting body, yet this does not follow from the definition of that word. According to Hippocrates, it is a tumid round body, ſoft, ſmooth, and ſhining. Many ſuch bodies, and which we call glands, have no excretory ducts, and do not ſecrete a fluid; while moſt ſecreting parts admit of no ſuch definition. When, again, we admit the definition of authors who have taught their peculiar opinions regarding their ſtructure, we have a ſtill leſs admiſſible deſcription.

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* The terms acini, cotulæ, cryptæ, foliculi, glandulæ, lacunæ, loculi, utriculi, have been almoſt promiſcuouſly uſed; being ſo many names for bundles, bags, bottles, holes, and partitions.

Thus Malpighi defined a ſimple gland to be "Membrana cava cum emiſſario;" and Ruyſch ſays, "Glandulæ nullæ componuntur ex ſola membrana cava cum emiſſario, ſed præcipue ex vaſis."

Theſe definitions of glands being optional and uncertain, it is neceſſary to uſe names appropriated to the ſeveral varieties of form in ſecreting parts. Indeed the term gland is inadmiſſible as conveying any knowledge of the minute parts of which the viſcera are compoſed.

We muſt obſerve, however, that there is a diviſion of glands ſtill in uſe into *conglobate* and *conglomerate*. The firſt implies a gland ſimple in its form, the latter a gland having the appearance of an aſſemblage of ſeveral glands *. Now there is no gland that has not more or leſs the appearance which is deſcribed by conglomerated; that is, conſiſting of ſeveral parts, united by cellular membrane: and the diſtinction is attended with no advantage.

Acini form the laſt ſub-diviſion which we obſerve in the viſcera, as in the liver; they are round bodies, not regularly inveſted with membranes, and which can be teaſed out into parcels of minute veſſels †.

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* As the ſalivary glands and the pancreas. Farther, the lymphatic glands are generally called conglobate glands, being ſmooth and apparently ſimple in their ſtructure; but theſe, when injected, take exactly the appearance which ſhould naturally be deſcribed by the term conglomerate, conſiſting of many little cavities. Theſe lymphatic glands, belonging to a diſtinct ſyſtem, require no farther particular definition to diſtinguiſh them.

† See farther of the acini of the liver for example.

Cryptæ are numerous in the body. We have an example of them in the great inteſtines [*]. Crypta is a ſoft body, conſiſting of veſſels not completely ſurrounded with a membrane, and reſolvable by boiling or maceration [†].

Folicules are little bags appended to the extremity of the ducts, into which the ſecretion is made, and from which it is evacuated by the ducts.

Lacunæ are little ſacs opening largely into the paſſages, (as in the urethra,) and into which generally mucus is ſecreted; which, lodging there, is diſcharged when matter moves along the paſſage.

Finally, we have to recollect that every part of the body ſecretes; that every ſurface is a ſecreting ſurface; that even that ſurface which is produced by an inciſion no ſooner ceaſes to bleed than a ſecretion begins. And that an ulcer in the ſkin or fleſh becomes by habit ſimilar to thoſe organs the peculiar functions of which is to ſecrete ſome matter uſeful in the ſyſtem. This fact corrects the notions which we ſhould otherwiſe be apt to receive of the action of ſecretion from contemplating the more complicated glandular organs.

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[*] Ruyſch ad Virum Clar. H. Boerhaave, p. 53.

[†] "Cryptarum vaſcula poſſum docere, ſed ſunt tam ſubtilia, ut reptatus non poſſit diſtingui; tantum circum affuſa rubedo per repletionem videtur." Ruyſch ad Her. Boerhaave, p. 77.

CHAP. I.

OF THE ABDOMEN IN GENERAL, AND OF THE PERITONEUM.

THE abdomen is that diviſion of the body which is betwixt the thorax and pelvis. It is bounded above by the arch of the diaphragm; behind, by the ſpine; on the ſides and fore part, by the abdominal muſcles; and, below, the abdominal viſcera are ſupported by the alæ ilii and the pubis. The abdomen contains the viſcera more or leſs immediately connected with digeſtion, and the kidneys which ſecrete the urine.

We ſpeak of the cavity of the abdomen; but it is an inaccuracy of language; for there is really no cavity: The parietes of the abdomen, viz. the abdominal muſcles and peritoneum, cloſely embrace the contained viſcera. To underſtand what is meant by the cavity of the abdomen; to underſtand the connection of the ſeveral viſcera, and the manner in which they lie contiguous, while they adhere at certain points only; we muſt previouſly attend to the peritoneum. But, in the firſt place, let us notice the outward diviſions of the belly.

OF THE REGIONS OF THE BELLY.

To give greater accuracy to the deſcription of the ſeat of the viſcera, or, perhaps rather, more ſtrictly to connect the knowledge of the internal parts with the outward marks of the belly, it has been long cuſtomary to mark certain arbitrary diviſions on its ſurface, which are called regions.

The EPIGASTRIC REGION is the upper part of the belly, under the point of the ſternum and in the angle made by the meeting of the cartilages of the ribs with the ſternum. Upon the ſides under the cartilages of the ribs are the HYPOCHONDRIAC REGIONS, or the right and left hypochondrium. Theſe three regions make the upper diviſion of the abdomen, in which are ſeated the ſtomach, liver, ſpleen, pancreas, duodenum, and part of the arch of the colon. The ſpace ſurrounding the umbilicus, betwixt the epigaſtrium and a line drawn from the creſt of one os ilii to the other, is the UMBILICAL REGION. The HYPOGASTRIC REGION is of courſe the loweſt part of the belly, conſiſting of the angle betwixt the umbilical region, the ſpines of the oſſa ilii and the pubis. The two lateral ſpaces betwixt the falſe ribs and the ſpine of the os ilii are the ILIAC REGIONS, or the LOINS.

OF THE PERITONEUM.

THE Peritoneum, like all the other membranes of the body, conſiſts of an expanſion of denſe cellular membrane; yet it is what is called a proper or ſimple membrane; being a white firm thin contexture of cellular ſubſtance, in which no fibre or ſtriated appearance is to be obſerved *. By its outer ſurface it adheres to the

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* The meaning of ſome anatomiſts, ſaying that the peritoneum is a double membrane, will be ſeen below.

the adipoſe membrane, on the inſide of the abdominal muſcles, and to the ſurface of the ſeveral viſcera; its inner ſurface is ſmooth, and forms no adheſion while the parts are ſound and healthy; its outer ſurface is looſer in its texture, and by the ſplitting of its lamina it degenerates into the common cellular membrane.

The cellular membrane on the outſide of the peritoneum is in ſome places ſhort, firm, and denſe; as on the liver, the ſpleen, the uterus, and the inteſtines: but it is longer, lax, and fatty, where it attaches the peritoneum to the muſcles and tendons of the abdomen.

The peritoneum has no termination; or it is a ſac; yet ſo curiouſly is it involved with the viſcera, that though we ſay the viſcera are contained in the abdomen, yet, accurately ſpeaking, they are without the peritoneum, and conſequently lie not in the abdominal cavity *.

The peritoneum is expanded on the lower ſurface of the diaphragm; and at ſome of the interſtices or perforations of that muſcle or its tendon it comes in contact with the pleura, and adheres to it by cellular ſubſtance. From the diaphragm the peritoneum is reflected off to the liver, forming the ligaments of that viſcus, and, expanded over its ſurface, it forms its outer membrane. From the diaphragm it is alſo ſent off upon the œſophagus and ſtomach, and prolonged to the ſpleen on the left ſide (as it is to the liver on the right) ſo as to form the ligaments of the ſpleen.

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* See Plate I. and the explanation.

The aorta, the great vena cava, the thoracic duct, and the kidneys, are behind the peritoneum; that membrane being ſtretched before them. But the inteſtines are alſo in the ſame reſpect behind this general inveſting membrane; for it is merely reflected from the ſpine and pſoas muſcles, and from the great veſſels running down upon the ſpine, ſo as to involve the inteſtines and form their outer coat. As it ſtretches towards the tract of the inteſtinal canal, it conſequently involves the veſſels of the inteſtines in its duplicature, and forms the meſentery.

The peritoneum alſo lines the abdominal muſcles: it is reflected from the diaphragm upon the ſurface of the tranſverſalis and rectus abdominis muſcles. Here it is united to them by a looſe adipoſe membrane, and from the abdominal muſcles it is continued upon the inſide of the pubes. From the pubes it aſcends upon the bladder of urine; deſcends again behind the bladder; and there, making another reflection to mount over the rectum and form the meſo-rectum, it leaves betwixt the rectum and bladder a particular ſacculus.

From this detailed deſcription we ſee that the peritoneum has no termination: that it is continued from the ſurface of the diaphragm to that of the abdominal muſcles; from that over the bladder and rectum; from the rectum in the whole length of the inteſtinal canal; and from the inteſtinal canal up upon the diaphragm. We ſee then what is meant when it is ſaid that it is a ſhut ſac; we underſtand by the cavity of the peritoneum merely the inſide of this ſac; and that when diſtended with fluid, that fluid is contained betwixt the peritoneum lining the abdominal muſcles and that part of it which inveſts or forms the outer membrane or coat of the inteſtines. This fluid, whether collected there by diſeaſe or thrown in by experiments, has no natural outlet, nor does it tranſude in the living body *.

BLOOD-VESSELS OF THE PERITONEUM.

As the peritoneum is a membrane of great extent, and inveſting a variety of parts, its veſſels come from many ſources. It receives arteries and veins from the mammary veſſels; from the phrenic and epigaſtric veſſels; from the lumbar arteries and veins; and from the ilio-lumbalis, circumflexa ilii, renal, and ſpermatic arteries. It receives nerves from the intercoſtal, lumbar, and diaphragmatic nerves.

It would appear that diſeaſe has given riſe to the opinion that the peritoneum has in it many little glands. This is controverted deciſively by Morgagni.

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* Soemmerring, Corp. Hum. Fab. Contemp. Peritonei, § iii. We not unfrequently find an accurate general deſcription in authors, but ſome incorrectneſs in the ſubordinate detail; which throws back the ideas of the reader into confuſion. Such is the enumeration of the holes or perforations of the peritoneum, " pour donner paſſage à l'œſophage, à la veine-cave," &c. See Anatom. Chirurg. par M. Palſin. We ſee that there are no ſuch perforations, that the œſophagus never enters into the cavity of the peritoneum, nor does the rectum paſs out from its cavity. This was indeed explained by Fernelius in oppoſition to Galen. See a deſcription of the inflections of the peritoneum by Bartholin,—Spécimen Hiſtoriæ Anatomicæ Analect. Ob. I.

OF THE USE OF THE PERITONEUM.

THE peritoneum ſerves as a denſe and outer coat to the abdominal viſcera; conveys the veſſels to them, as in the example of the meſentery; and, having its inner ſurface ſmooth and lubricated by a watery ſecretion, it allows the parts to lie in contact (they being ſtrongly compreſſed by the ſurrounding abdominal muſcles and diaphragm), and at the ſame time allows in the inteſtinal canal a capacity of motion without friction.

There is no internal ſurface or cavity, as it is called, of the living body, which is not moiſtened by an exudation from the veſſels of the ſurface. Thus it is with the peritoneum. An exhalation from the extreme arteries bedews its ſurface, and is again taken up by abſorbent veſſels; ſo that it does not accumulate in health, nay even fluids poured into the abdominal cavity will be taken up by the abſorbents *. When the abdomen is opened in animals alive, or recently killed, as in the ſhambles, a vapour is ſeen to exhale from the peritoneum having a peculiar animal odour. Yet we ought not to ſay that this vapour is collected in the

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* See Nuck Sialograph. c. ii. p. 27.

Qua copia in ſtatu ſecundùm naturam ſecernatur dictu difficile eſt: ad uncias certe collecta aquula in ſani hominis abdomine reperitur. (Kaawn, 543.) In homine, cui ſponte abdomen ſub umbilico ruptum erat ad quinque & ſex libras de die effluebat. (Journ. de Med. 1757. M. Aug. ut denique 800 libr. effluxerent). This, however, proves nothing of the nature or quantity of the ſecretion; this has probably been an inflammation and abſceſs of the peritoneum, which, we have ſeen, pours out ſuch a quantity of fluid, thin and ſerous, as quickly to drop through the bed-clothes upon the floor.

dead body; for before the opening of the peritoneum, or the death of the animal, it is not in a ſtate of vapour, but is condenſed into a watery exudation *. I have ſeen, in the high ſtate of inflammation of this membrane, pus formed upon the ſurface without ulceration, and therefore, probably, from the ſame exhaling or ſecreting ſurface; and coagulable lymph lying in flakes upon it. The increaſe of the ſerous diſcharge forms the common aſcites; but whenever the natural ſecretion or exudation from the peritoneum is altered, adheſions are apt to form.

One great uſe of the peritoneum is to retain the viſcera in their place, ſays Haller; for when it is wounded they eſcape, and ſometimes with a ſudden impetus, which makes it difficult to reduce or retain them †. But this is not from the want of the embracing of the peritoneum, but from the tendons or muſcles which ſupport the peritoneum being cut; for when there is a deficiency in the ſupport given by the abdominal muſcles, or their expanded tendons, the peritoneum does not prevent the viſcera from being protruded, but eaſily yields to their forcible protruſion, and forms a ſac involving this hernia.

Nor do the proceſſes of the peritoneum, which have received the name of ligaments, nor the meſentery, nor meſocolon, ſufficiently reſiſt the prolapſus of the viſcera when they have eſcaped from the preſſure of the ſur-

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* This vapour I have ſeen ariſing from the inteſtines of the human body during the operation for hernia; and alſo when the omentum and inteſtines have eſcaped in conſequence of a wound of the belly.

† Element. Phyſiol. tom. ii. p. 380.

rounding muſcles. Sufficient example of this we have in hernia of the inteſtines, in which the meſentery is greatly elongated, or in the diſplacement of the ſtomach, or in the prolapſus and procedentia uteri.

The peritoneum which forms the ſac of hernia retains little elaſticity, and does not ſhrink into the belly when freed from the outer adheſions; but the general peritoneum will allow great diſtenſion, as in aſcites, and quickly contract to its former dimenſions on the evacuation of the fluid; and ſo that part of the membrane which inveſts the ſtomach and inteſtines the bladder of urine and gall bladder, has conſiderable elaſticity, ſince it ſuffers theſe parts to be diſtended and again returns to its former dimenſions.

The conſideration of the inſufficiency of the peritoneum to retain the viſcera leads us to attend to a circumſtance of the greateſt importance connected with the viſcera of the belly. The abdomen is everywhere (except towards the ſpine) ſurrounded by muſcles. Above we ſee the diaphragm; before, and to the ſides, the abdominal muſcles; and even below, the parts in the pelvis are ſurrounded and compreſſed by the levator ani, in ſuch a manner that the whole of the viſcera ſuffer a continual preſſure. This preſſure upon the viſcera appears to be uniform and conſtant, notwithſtanding the alternate action of the abdominal muſcles and diaphragm as muſcles of reſpiration: but it muſt be occaſionally very violent during exertions; in pulling, for example, or in ſtraining, as a ſailor muſt do in working of the great guns, or when pulling at the oar, or when balancing himſelf upon his belly over the yard-arm. And indeed by ſuch violent and general compreſſion of the viſcera of the belly, ruptures are ſometimes produced, of the worſt kind, and followed by the immediate train of urgent ſymptoms.

The viſcera having in general delicate outer coats, and no ligaments capable of ſupporting them, and being very vaſcular, require the ſupport of this preſſure of the ſurrounding muſcles; and the great venous trunks which take their courſe through the abdomen are in a particular manner indebted to the preſſure of the abdominal parietes. We muſt recollect alſo the bad conſequences which reſult from the ſudden relaxation of the abdomen; as in women after delivery, or in conſequence of withdrawing the waters of aſcites without due compreſſion of the belly; languor, faintneſs, and even death, are ſometimes produced, apparently by the balance of the vaſcular ſyſtem being deſtroyed.

Some good authors in former times have deſcribed the peritoneum as a double membrane *. This was no farther a miſtake than as they conſidered the cellular membrane, which lies without the peritoneum, as a part of it. It is neceſſary to recollect this in order to underſtand the meaning of their calling the ſheath of the cellular membrane, which accompanies the veſſels paſſing out from the abdomen, productions of the peritoneum. The vaginal productions of the peritoneum are the ſheaths of the common cellular ſubſtance which accompany the aorta and œſophagus into the poſterior mediaſtinum; or which give a bed to the

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* See Anat. Chirurg. par M. Palfin, tom. II. p. 35. and note *a*.

ſpermatic veſſels, or paſſing under Poupart's ligament accompany the veſſels of the thigh. They are improperly termed productions of the peritoneum.

The proper productions or prolongations of the peritoneum are of a very different kind; they are the meſentery and omenta and ligaments: but, as I have explained in general how the meſentery and ligaments are formed by the peritoneum, and as they muſt come preſently to be conſidered more particularly, we treat no farther of them here *.

OF THE OMENTA.

THE Omenta are conſidered as ſecondary proceſſes of the peritoneum, becauſe they are not formed by the peritoneum reflected off from the ſpine upon the inteſtines, as the meſentery is,—it being a primary proceſs; but they are reflected from the ſurface of the ſtomach and inteſtines. Anatomiſts diſtinguiſh the omentum majus,—colico-gaſtricum: the omentum minus,—hepatico-gaſtricum; omentum colicum; and laſtly, the appendices epiploïcæ.

The OMENTUM, or EPIPLÖON, meaning thereby the great omentum, is a floating membrane of extreme delicacy, expanded over the ſurface of the ſmall inteſtines, and attached to the great arch of the ſtomach and inteſtinum colon. Although this membrane be of extreme delicacy and tranſparency in the young

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* See farther of the peritoneum under the head Meſentery, Meſocolon, Deſcent of the Teſticle, &c.

ſubject [*], yet it is much loaded with fat, and appears tranſparent in the interſtices only; and in advanced age it loſes much of its delicacy, and acquires a degree of diſeaſed conſolidation or firmneſs, and is often irregularly collected into maſſes, or adheres preternaturally to ſome of the viſcera.

The omentum majus hangs ſuſpended from the cellular connection betwixt the arch of the ſtomach and the great tranſverſe arch of the colon; or rather it forms that connection betwixt the ſtomach and colon. It conſiſts of two membranes, or is as a ſac collapſed and hanging from the ſtomach and colon [†], one of the ſides being the peritoneum reflected off from the œſophagus and alongſt all the great arch of the ſtomach, and the other that which comes from the arch of the colon. And further, as each of theſe lamina may be ſuppoſed to conſiſt of two lamina; for example, where the omentum is formed by the meeting of the peritoneum from the lower and upper ſurfaces of the ſtomach; theſe two, meeting, form the upper lamina: and as, where the lower layer of the omentum comes off from the colon, it is alſo formed by the peritoneum reflected in the ſame manner; ſo with ſome truth the omentum is ſuppoſed to conſiſt of four lamina of membranes of extreme tenuity: but theſe four layers cannot be demonſtrated. The great omentum extends from the boſom of the ſpleen tranſverſely, until it terminates on the right ſide of the arch of the colon, where the omentum colicum begins.

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[*] Præterea tenerrimas eſſe ut nulla membranarum humanarum, retina oculi excepta, æque ſit tenera.

Haller, vol. vi. lib. 20. § 1. par. 12.

While its delicacy is remarkable in the young ſubject, the retiform veſſels (vid. Ruyſch. Ther. II. Q. V. Spegil. LVIII. &c.) have the fat accumulated in their tract as if it were thrown up by them to a ſide; but often the fat increaſing obſcures the veſſels.

[†] Marſupium the common term.—See Winſlow, IV. § 352.

The great omentum varies conſiderably in extent. In a child it is ſhort; in the adult further extended over the viſcera: ſometimes it reaches only to the umbilicus; ſometimes it is allowed to extend its margin into the pelvis, ſo that in old people it is very apt to form a part of the contents of hernia: often it is waſted and ſhrunk; ſometimes collected into maſſes leaving the ſurface of the inteſtines.

OF THE OMENTUM MINUS OR HEPATICO GASTRICUM.

THIS is a membrane of the nature of that laſt mentioned, but in general leſs loaded with fat. It is extended from the liver to the leſſer arch of the ſtomach. It paſſes off from the lower ſurface of the liver at the tranſverſe foſſa; from the foſſa ductus venoſi; inveſts the lobulus ſpigellii; involves the branches of the cæliac artery; and is extended to the leſſer curvature of the ſtomach and the upper part of the duodenum *.

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* "Macilentius eſt, et vaſa habet minora." Winflow. Haller. Indeed it ſeems rather to anſwer the general purpoſe of a cellular membrane conveying veſſels, than the purpoſes of the omentum majus.

OMENTUM COLICUM.

THIS is a continuation of the great omentum upon the right ſide of the great arch of the colon, where it riſes from the caput coli; but it ſeldom extends its origin from the colon the length of the caput coli. It can be inflated like the great omentum.

APPENDICES EPIPLOICÆ, OR OMENTULA INTESTINI CROSSI.

THESE are little fatty and membranous proceſſes which hang pendulous from the ſurface of the colon: they are of the ſame texture and uſe with the greater omentum and right colic omentum.

We have mentioned that the omenta are double reflections from the peritoneum, and conſequently they may be inflated ſo as to demonſtrate them to be perfect ſacs. To do this it is not required to puncture any part of them, for there is a natural opening by which the whole may be inflated in a young ſubject, and in a healthy ſtate of the viſcera.

This natural opening into the purſe or ſac of the omentum is betwixt the membrane involving the veſſels and ducts of the liver, and the peritoneum, where it inveſts the vena cava betwixt the neck of the gall bladder and the firſt turn of the duodenum, or where the lobulus caudatus hepatis touches the duodenum. By introducing a blow pipe into this natural fiſſure the foramen of Winſlow, the omentum minus may be raiſed: the gaſtro colic, and colic omenta may be inflated. This opening ſerves as a communication betwixt the cavities of the omentum and the general peritoneal cavity; but I am inclined to think it is very frequently deſtroyed by adheſions *. As this opening points towards the right ſide, Dr. Monro thinks it a ſufficient reaſon for introducing the trochar on the right ſide in the operation of tapping for aſcites, (contrary to the uſual caution of avoiding the liver, which is ſo often diſeaſed in this caſe,) and that by operating on the left ſide he thinks the water will not be allowed to flow from the ſac of the omentum †. It appears to me that it will flow equally well from whatever point of the belly the water is drawn.

There is a conſiderable variety in the form of the omentum of animals ‡, but ſtill they ſeem to ſhew the ſame proviſion of involving the inteſtines, filling up the inequalities which ariſe from the rounded forms of the viſcera, and ſtill further lubricating and giving mobility to the inteſtines §. The ſurface of the omentum,

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* Winſlow, Duverney, and Haller.

† *Quer.* If I ſhould ſay to a patient, By puncturing here I am in danger of thruſting this inſtrument into your liver; by introducing it here there is leſs poſſibility of any ſuch accident, though I may not draw off all the water; what would be her anſwer?

‡ Haller Element. Phyſiol. tom. vi. lib. xx. § 2 and 3.

§ We muſt not ſuppoſe that becauſe a mad-man ſtabs himſelf in the belly, and there is afterwards found coalition of the inteſtines to the wounds, the omentum has not done its office, (ſee Boerhaavii Prelectiones, vol. i. § 45.) no more can we give credit to the tale told by Galen (De Uſu Partium, l. iv. c. 9.) of the gladiator who loſt part of the omentum, and ever after had a coldneſs in his guts! at leaſt we cut out a great part of the omentum from a man without any ſuch ſenſation being the conſequence now-a-days.

tum, however, ſeems merely to furniſh a fluid exudation like the general ſurface of the peritoneum; at leaſt the idea which has been entertained of the oil or fat exuding is quite improbable *.

The uſe aſſigned to the omentum of being ſubſervient to the function of the liver is deſervedly neglected †.

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* "Et dum halitu pingui & ipſa obungit & peritoneum." Hale loc. cit. Boerhaave, &c.

† Viz. by ſupplying a groſs oily matter to the venæ portæ.

CHAP. II.

OF THE MEMBRANEOUS VISCERA OF THE ABDOMEN *.

HAVING underſtood the nature of the general inveſting membrane of the abdomen, and what is meant by its cavity and its proceſſes, we take a general ſurvey of the œconomy of the viſcera, before entering upon the minute ſtructure of the parts individually.

The organs deſtined to receive the food, and to perform the firſt of thoſe changes upon it which fit it (after a due ſucceſſion of actions) for becoming a component part of the living body, are the ſtomach and inteſtines primarily; the glandular viſcera, the liver, pancreas, (and in all likelihood the ſpleen,) as ſubſervient or ſecondary organs. I have been accuſtomed in my lectures to divide theſe parts into the membranous or floating viſcera, (viz. the whole track of the inteſtinal canal) and the glandular viſcera; or perhaps, what is ſtill better, they may be diſtinguiſhed into thoſe parts which have action and motion, and thoſe which are quieſcent or poſſeſſed of no power of contraction. Thus the ſtomach, inteſtines, gall-bladder, and bladder of urine (though this belongs to the pelvis)

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* Although the term Viſcus implies more particularly the fleſhy or ſolid contents, as the heart, liver, kidnies, yet we uſe it in general for all the parts contained in the great cavities.

pelvis) have muſcular coats, and the power of contracting their cavities; while the liver, ſpleen, pancreas, and kidnies, have no muſcularity but in their veſſels and excretory ducts.

This diviſion of the viſcera may lead to important diſtinctions in pathology. During inflammation, it is obſerved, that though the parts poſſeſſing a power of contraction may ſometimes lie inactive without pain, yet in thoſe parts when rouſed to action there is excruciating pain. On the other hand, it often happens that the glandular and ſolid viſcera are the ſeat of long continued diſeaſe, which is attended only with a dull or low degree of pain; while the anatomiſt is often ſtruck upon examining the body after death with the wide ravages of the diſeaſe.

We divide the inteſtinal canal into three parts; the ſtomach, the ſmall inteſtines, the great inteſtines. The ſmall inteſtines are ſubdivided into the duodenum, jejunum, and ileon. The great inteſtines are ſubdivided into the cæcum, colon, and rectum. The ſtomach is the ſeat of the digeſtive proceſs: in the duodenum the food receives the addition of the ſecretions from the liver and pancreas, and is ſtill further adapted to animalization; in the long tract of the jejunum and ileon the nutricious part is abſorbed; and in the great inteſtines the effete matters are carried ſlowly forward, and at the ſame time ſuffer a further abſorption of their fluid contents, until as fœces they lodge in the rectum or laſt diviſion of the canal.

From this view it is apparent that as each diviſion of the inteſtinal canal is marked by ſome peculiarity in its uſe or function, we muſt carefully examine their minute ſtructure as individual parts, at the ſame time that we do not allow ourſelves to forget the univerſal connection, the integrity of the circle of actions, and the œconomy as a whole. With this intention, following the courſe of the food, and with a view alſo to connect the preſent ſubject with the laſt part of vol. iii. we treat firſt of the œſophagus.

SECTION I.

OF THE ŒSOPHAGUS.

THE œſophagus or gullet is a cylindrical tube, partly membranous and partly fleſhy; which is continued from the pharynx down behind the larynx and trachea and cloſe before the ſpine. Still continuing its courſe in the back part of the thorax, it perforates the diaphragm, and expands into the upper orifice of the ſtomach; its uſe is to convey the food by deglutition into the ſtomach.

Although with many authors I call it a cylindrical tube, and it may take this form when diſſected from the body and inflated, yet during life it lies collapſed with its inner membrane in cloſe contact, and it tranſmits the morſel only by the continued ſucceſſion of the contraction of its fleſhy coat.

The upper part of this tube is called the pharynx. It may be deſcribed as expanding funnel-like, and is attached to the occipital bone, pterygoid proceſſes of the ſphenoid bone, and jaw bones; and further down it is kept expanded upon the horns or proceſſes of the os hyoidis. This bag is very fleſhy, being ſurrounded with muſcular fibres, which take their origin from the neighbouring points of bone; as the ſtyloid proceſs, the horns of the os hyoidis, the thyroid cartilage *; by which it is enabled to graſp and contract upon the morſel when it has been thruſt by the tongue behind the iſthmus faucium. This ſtrong tiſſue of muſcular fibres which ſurrounds the pharynx, is continued down upon the œſophagus in the form of a ſheath, which has been called vaginalis tunica.

STRUCTURE OF THE ŒSOPHAGUS.

I BELIEVE we can with propriety enumerate no more than two proper coats of the œſophagus; its muſcular and internal coat: for that which is ſometimes conſidered as the outer coat, is only the adventitious cellular membrane, and the nervous coat is merely cellular tiſſue connecting the muſcular and inner coat.

The MUSCULAR COAT of the œſophagus greatly ſurpaſſes in ſtrength and in the coarſeneſs of its fibres any part of the whole tract of the inteſtinal canal. There may be very diſtinctly obſerved in it two layers of fibres; an external one conſiſting of ſtrong longitudinal fibres, and an internal one of circular fibres. Theſe lamina of fibres are more eaſily ſeparated from each other than thoſe in any other part of the body †. But

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* See vol. i. p. 228.

† It appears that the œſophagus can be ruptured in two ways: acroſs, by the tearing of the longitudinal fibres; and longitudinally, by the ſeparation of the longitudinal fibres. This, though a rare accident, takes place in violent vomiting or ſtraining to vomit; and, in the firſt inſtance, the tearing acroſs of the œſophagus

But an idea is entertained that the one ſet of fibres, the circular and internal ones, are for contracting the tube, and the outer ones for elongating and relaxing it. I believe on the other hand that they contract together, conducing to one end, deglutition *.

What is called the TUNICA NERVEA is the cellular connection betwixt the muſcular and inner coat, and is very lax, inſomuch that the muſcular coat and the inner coat are like two diſtinct tubes, the one contained within the other, and but ſlightly attached. This appearance is preſented particularly when the œſophagus is cut acroſs.

The INNER COAT of the œſophagus is ſoft; glandular villi are deſcribed as being diſtinguiſhable on its ſurface, and it is inveſted with a very delicate cuticle to dull the acute ſenſibility, and prevent pain in ſwallowing. It in every reſpect reſembles the lining membrane of the mouth. The power, however, which the œſophagus ſeems to poſſeſs of reſiſting heat depends not on the inſenſibility beſtowed by the cuticle, but is owing to the rapid deſcent of the hot ſolids or liquids ſwallowed; for when they happen to be detained in the gullet they produce a very intolerable pain. This inner coat has an exhaling ſurface, like the reſt of the body, with particular glands to ſecrete and pour out that

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phagus ſeems to be the effect of the action of the diaphragm on the œſophagus. By this accident the fluids of the ſtomach are poured into the cavity of the thorax.

* See farther of the muſcular coat of the inteſtines. "It was at one time ſuppoſed that the muſcular fibres of the œſophagus had a ſpiral direction." See Verheyen, and Morgan. Adverſar. iii.

that mucus which lubricates the paſſage for the food *. The inner coat is capable of a great degree of diſtention, but it is not very elaſtic, or at leaſt contraction of the muſcular coat throws it into longitudinal folds or plicæ †.

In the neck, the œſophagus lying betwixt the cervical vertebræ and the trachea, is at the ſame time in a ſmall degree towards the left ſide. In the thorax it runs down betwixt the pleura of either ſide, where they form the poſterior mediaſtinum. Here, even when it deſcends upon the dorſal vertebræ, the œſophagus lies rather to the left ſide; it then paſſes under the arch of the aorta, but quickly eſcapes from under its compreſſion and riſes on the right ſide of the aorta, and as it paſſes further down it gets more and more before the aorta. This is ſufficiently apparent when we attend to the relation of the perforations in the diaphragm for tranſmitting the aorta and the œſophagus.

Behind the œſophagus, in the thorax, there are one or two lymphatic glands, which were underſtood by Veſalius to belong to the œſophagus. What deceived him

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* Theſe glands ſuffer ulceration and ſchirrous hardening, and are a terrible cauſe of difficulty of ſwallowing.

† Some part of the food lodging in the natural lacunæ of the œſophagus, or ſome ſolid body, as the ſtone of fruit being received into them, has been the cauſe of a ſac forming in the pharynx or œſophagus. And it has happened that ſuch a ſac, gradually and for years enlarging, has formed a bag, into which nearly the whole food, that ſhould have paſſed into the ſtomach, was received, ſo as to oppreſs the œſophagus and occaſion a lingering death. An example of this is to be ſeen in my muſeum.

him is an appearance generally to be obſerved in theſe glands. The lymphatics, or the ſmall branches of veins, are generally filled with a black matter, which, extending to the coats of the œſophagus, reſemble very much the ducts of the glands going to open into the œſophagus [*].

The inner coat of the œſophagus ſhows ſo very different a texture from that of the ſtomach, and this difference is marked by ſo very abrupt a line, as ſufficiently to indicate that the fluids poured out from the œſophagus are very diſtinct from thoſe of the ſtomach, and have no power of digeſtion.

SECTION II.

OF THE STOMACH.

Seat, Form, Diſplacement of the Stomach.

THE ſtomach lies under the margin of the ribs of the left ſide, and chiefly in the left hypochondrium. Its greater extremity is on the left ſide, in contact with the diaphragm; but towards the right, the ſhelving edge of the horizontal lobe of the liver is betwixt it and the diaphragm. On the lower part it is, by the meſocolon and arch of the colon, divided from the ſmall inteſtines; and to the greater extremity the ſpleen is attached by veſſels and by the looſe intertexture of the omentum. The ſtomach may be ſaid to be a conical ſac; the extremities of which being made to approach each other, gives it the curve of a hunter's horn, and gives occaſion to the anatomiſt, in ſtrict deſcription, to remark theſe parts; the SUPERIOR OR CARDIAC orifice into which the œſophagus expands; the LOWER OR PYLORIC orifice, which leads into the duodenum: the LESSER AND GREATER CURVATURES of the ſtomach.

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[*] Theſe glands in the poſterior mediaſtinum are ſometimes diſeaſed, and enlarged ſo as to compreſs the œſophagus and to cauſe ſo permanent an obſtruction of deglutition as to kill.

The leſſer curvature of the ſtomach extends from betwixt the two orifices; includes in its embrace the ſpine, the aorta, and the ſmall central lobe of the liver, while there is attached to it the leſſer omentum. The greater curvature of the ſtomach is the outline of its diſtended belly, which riſes above the arch of the colon, and is marked by the courſe of the gaſtro-epiploic veſſels.

When the ſtomach is diſtended the lower orifice is nearly on a level with the upper one; but when the ſtomach is allowed to ſubſide, it falls conſiderably lower; ſo that whilſt the ſtomach is lying acroſs the abdomen it is alſo tending obliquely downwards. The enſiform cartilage will be found to preſent commonly to the middle of the ſtomach; and the lower orifice, when in its natural ſituation, is oppoſite to the foſſa umbilicalis of the liver: the upper orifice is kept conſtantly in one place from the ſtricter connection of the œſophagus with the diaphragm.

Both orifices of the ſtomach preſent backward, eſpecially the upper one, while the lower one is pointed backward and downward. By the diſtention of the ſtomach the great arch is extended, the orifices are directed more backward and towards each other, and eſpecially the greater extremity draws upon the œſophagus.

phagus. By theſe means I conceive that there is ſometimes produced a difficulty of the ſtomach diſcharging its contents when greatly diſtended, the orifices being in a great meaſure turned from the œſophagus and duodenum.

The ſtomach being liable to frequent varieties in its degree of diſtention, the natural relation of parts muſt frequently be altered. It ought to be particularly recollected, that in the living body the ſtomach is ſupported and bound up by the inteſtines; ſo that the great curve preſents: and the broad anterior ſurface which the ſtomach preſents in the dead body is turned directly upward, and the inferior downward *. By the collapſing of the ſtomach and the conſequent falling down of the liver ſome have explained the ſenſation of hunger, conceiving that the uneaſy ſenſation proceeds from the liver being allowed to hang upon the broad ligament †. From the great ſimplicity of mechanical explanation phyſicians have eagerly indulged in them, but it will in general be found that when they are applied to the explanation of the phenomena of a living body they are inadmiſſable.

OF THE COATS OF THE STOMACH.

THE coats or membranes forming the ſtomach are, the outer, the muſcular, the nerous, the vilous, and the three cellular

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* Thus the gaſtro-epiploic artery preſents directly forward. It has been wounded, and bled both into the ſtomach and outwardly. I ſhould conceive it poſſible in ſuch a caſe to tie the artery.

† Winſlow.

cellular coats. For theſe ſubdiviſions, however, I ſee no uſe, nor are they authoriſed by the natural appearance of the coats of the ſtomach. When there is a diſtinction in texture, ſtructure, or function, and where theſe lamina can be ſeparated, we ſhould conſider them as coats; but a mere intermediate tiſſue of veſſels, or the connecting cellular membrane, are improperly conſidered as diſtinct tunics.

First coat.—From what has been already ſaid of the peritoneum, it will readily be allowed that the outer coat of the ſtomach is formed by the peritoneum; a coat common to all the inteſtines. Were this not ſufficiently evident in itſelf, it might be aſcertained by diſſecting the peritoneum from the cardiac orifice of the ſtomach, where it will be found reflected from the diaphragm. This coat is firm, ſimple in its texture, having no apparent fibrous texture, and ſmooth on its outer ſurface, with many minute veſſels. Under the peritoneal coat is the firſt cellular coat, being in fact a ſhort cellular tiſſue betwixt the peritoneal coat and the muſcular coat.

Muscular coat.—The muſcular coat of the ſtomach conſiſts chiefly of two lamina of fibres; leſs diſtinct however than thoſe of the œſophagus, or, in other words, more cloſely and irregularly connected. One ſet of fibres runs longitudinally, that is, from the one orifice to the other; the other ſet runs encircling the ſtomach; yet there are ſuch irregularities that it is difficult in every place to recognize the two great and original diviſions of fibres; and on this account in general three ſtrata or ſeries of fibres are deſcribed.

ſcribed *. For an example of this apparent irregularity, there comes down upon the flat ſide of the ſtomach an irregular faſciculus of fibres, apparently from the longitudinal fibres of the cardiac orifice, and continued from thoſe of the œſophagus, which yet take a courſe fairly encircling the ſtomach. They cannot be ſtrictly ſaid to belong to either the circular or longitudinal ſeries, and in many places thoſe which run longitudinally on the ſtomach ſeem to ſink and loſe themſelves amongſt the lower fibres, or are reflected into tranſverſe fibres.

Theſe muſcular fibres of the ſtomach do not run in an uninterrupted courſe, but ſplit, rejoin, and form a kind of retiform texture through which the coats beneath are at intervals diſcernible. This ſtructure would appear to beſtow a greater power of contraction on the ſtomach. The ſtrong longitudinal fibres which are ſeen upon the œſophagus form the outer ſtratum of the muſcular coat of the ſtomach, and they extend from the œſophagus and cardiac orifice in a ſtellated form alongſt the upper curvature, and downward upon the great end or ſacculus ventriculi. Then we have to obſerve a ſet of circular fibres, which forming rings upon the great end, extend over all the ſtomach, like the circular fibres of the arteries. Theſe fibres do not each encircle the ſtomach entirely, but while their general direction is circular, they are ſo interwoven that

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* The moſt general opinion is, that there are three layers of fibres in the ſtomach. Some deſcribe an external longitudinal ſeries; a middle tranſverſe ſtratum; and again the internal fibres running longitudinally. See Galeati Acad. de Bologne.

no one faſciculus can be followed to a great extent. Theſe are called the TRANSVERSE FIBRES or STRATUM; while the deepeſt ſtratum conſiſts of the continued circular fibres of the œſophagus. Theſe laſt fibres are ſtrong upon the cardiac orifice, and may be preſumed to form a kind of ſphincter; but they diminiſh as they are remote from the ſuperior orifice. The lower or pyloric orifice of the ſtomach, however, is more carefully guarded by muſcular fibres; having in the duplicature of the inner coats a diſtinct circular ring of muſcular fibres.

The cellular tiſſue, being intermingled with the muſcular fibres, connects and ſtrengthens them, and gives the appearance of little white lines interwoven with the muſcular fibres, and which ſome have deſcribed as ſmall tendons *. There is alſo to be obſerved a broad ligamentous band on the two flat ſurfaces of the ſtomach towards the pylorus. They are like the bands of the colon, but not nearly ſo ſtrong or evident. They are formed by the denſer nature of the cellular tiſſue, and more intimate union betwixt the firſt and ſecond coats.

OF THE ACTION OF THE MUSCULAR COAT.

UPON conſidering the weakneſs of the muſcular fibres of the ſtomach, and the membranous nature of the whole coats, it appears that the general action of the ſtomach is ſlow, regular, and by no means a forcible contraction; not an apparatus for triturating the food, but merely giving motion to its contents. But

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* See Winſlow, ſect. viii. p. 57.

regarding the extreme ſenſibility of the ſtomach, and the gradual and regular ſucceſſion of action, much will be found that is worthy of attention. It ſhould ſeem that the morſel is ſent down into the œſophagus by a ſucceſſion of actions, preceded by a perfect relaxation; and that when the food arrives at the ſuperior orifice of the ſtomach, by the ſame relaxation preceding the contraction, the muſcular fibres of the upper part of the ſtomach yield and receive the food compreſſed by the œſophagus. Attending to the form of the ſtomach, we ſee a proviſion for the reception of the food into the great ſacculated fundus on the left extremity. And here we ſhall find that there is a greater profuſion of veſſels for the ſecretion of the juices of the ſtomach, and a ſet of muſcular fibres, probably relaxing and yielding to receive the food, and excited to action only when the proceſs of digeſtion has been in part or entirely accompliſhed. We have proof that when the food has remained the uſual time in the ſtomach, and comes in ſucceſſion to be preſented at the lower orifice, if the ſtomach is healthy and the change upon the food perfect, the lower orifice is relaxed, and yields to the contraction of the muſcular fibres of the ſtomach, and the contents of the ſtomach are paſſed into the duodenum: but if the food has been of an indigeſtible nature, it is rejected. The pyloric fibres refuſe the neceſſary relaxation, and by the unnatural excitement an antiperiſtaltic motion is produced, and the matter is again thrown into the great end of the ſtomach, or rejected by vomiting. There is in the natural action of the ſtomach a ſtimulus, followed by a regular ſucceſſion of motion in its fibres, conveying the contents from the upper to the lower orifice of the ſtomach. Of this excitement and action we are not conſcious; but when the action is diſordered by an unuſual excitement, the lower orifice is not unlocked, the action becomes violent (the reverſe of what naturally takes place), and pain or uneaſy feelings are produced. Upon this principle may be explained the nauſea and vomiting which take place at certain times after eating, when balls or concretions are lodged in the ſtomach. While the food lies in the greater extremity, or in the body of the ſtomach, and the ball or concretion with it, there is no great excitement; but when it has ſuffered the neceſſary change, and is approaching to the pyloric orifice, this part, being as it were a guard upon the inteſtines, is ſuddenly excited, vomiting is produced, and the ball is thrown into its old place in the ſacculus or great end.

This great ſenſibility, producing effects almoſt like intelligence, is apparent in the more common diſorders of the ſtomach. We ſhall find the meteoriſmus ventriculi (the great diſtenſion of the ſtomach by flatus) exiſting for weeks, and yet the food paſſing in regular courſe through its orifices. We ſhall find very frequently food of difficult digeſtion lying in the ſtomach and oppreſſing its functions for days, while food more recently received may have undergone the actual changes, and have paſſed through the pylorus into the duodenum.

Owing to the ſame ſlow and ſucceſſive action of the ſtomach, it often happens that ulceration and ſchirrus pylorus, or other obſtruction of the lower orifice of the ſtomach, is attended with pain, nauſea, and vomiting,

miting, only at ſtated intervals after taking food; *i.e.* at the time in which the food ſhould be ſent into the inteſtines in the natural courſe of action.

The muſcular fibres of the ſtomach are excited by ſtimuli, applied, not to their ſubſtance, but to the contiguous coats; and betwixt the delicate ſurface of the inner coat and the muſcular fibres there is the ſtricteſt ſympathy and connection. The ſame connection holds in a leſs intimate degree betwixt the outer coat and the muſcular fibres; for when a part on the ſurface of the ſtomach of a living animal is touched with acid or ſtimulating fluids, the part contracts *. The ſtomach is conſidered as leſs irritable than the inteſtines, becauſe it is alleged that a ſtronger doſe of a medicine is required to prove emetic than to act as a purgative: but we ought to conſider that the action thus excited in the inteſtines is merely an acceleration of their ſecretions; but vomiting is the interruption of the uſual action, requiring ſuch a violent excitement as to invert the natural action.

But there is ſomething more than this; as the function of the ſtomach differs from that of the inteſtines, ſo may the quickneſs of their action. Thus in the ſtomach a gradual change is to be produced upon the food, requiring time and a ſlow degree of motion; but in the inteſtines there is a greater agitation of their contents, and a quicker action of their coats, to bring the fluids into more general contact with the abſorbing ſurface, and to give greater activity probably to the abſorption by the lacteals. I am inclined to think that the ſtomach is the moſt irritable part of the body, and ſuſceptible of the moſt minute diſtinctions in the nature of the ſtimuli applied to it. The phenomena of the living animal, and experiments in thoſe recently killed, ſufficiently prove the contractile powers of the two orifices. Experiments have been made which ſhew the powers both of the cardiac and of the pyloric orifices in retaining the contents of the ſtomach after the œſophagus and duodenum have been cut acroſs. The ſtomach of a rabbit has been ſqueezed in the hand after cutting the duodenum, without any of its contents having eſcaped *; and in ſimilar experiments, the finger being introduced into the lower orifice of the ſtomach of an animal yet warm, the fibres of the pylorus were found to contract ſtrongly upon it. Upon forcibly compreſſing the ſtomach, the food will be made to paſs into the œſophagus much more readily than into the duodenum; which is another proof how neceſſary the natural ſeries of actions is to the relaxation of the pylorus.

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* "In ea ſede quà tangitur, contrahitur, ſulcuſque profundus naſcitur, et rugæ; cibuſque aliquando propellitur ut à ſede contracta fugiat. Minùs tamen quàm inteſtina ventriculus irritabilis eſt; hinc emetica fortiora neceſſe eſt purgantibus."—Haller.

Of vomiting.—When there is an unuſual or unnatural irritation on the ſtomach, or when it is violently ſtimulated or oppoſed in its natural courſe of action, the motion becomes inverted; and drawing by ſympathy other muſcles to its aid, the contents of the ſtomach are evacuated by vomiting. Thus where the food takes changes inconſiſtent with healthy digeſtion; or when

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* See a paper in the 3d vol. of Sandifort, Theſ.

ſolid matters lodge in the ſtomach; or when ſecretions of the duodenum paſs into the ſtomach, or unuſual actions are propagated backwards upon the ſtomach from the upper portion of the canal; or when emetics are taken, which are unuſual ſtimuli; or when there is inflammation in the ſtomach, which, from giving greater ſenſibility, produces the ſame effect with more violent ſtimuli; or when the coats are corroded or ulcerated;—vomiting is produced. That vomiting may be produced by the inverted motion of the ſtomach and œſophagus alone, is apparent from experiments upon living animals, where the abdominal muſcles are laid open, and from caſes in which the ſtomach has lain in the thorax, and yet been excited to active vomiting*. Again, it is equally evident that, when the ſtomach is excited to vomiting, there is conſent of the abdominal muſcles, by which they are brought into violent and ſpaſmodic action; not alternating in their action, as in the motion of reſpiration, but acting ſynchronouſly, ſo as greatly to aſſiſt in compreſſing the ſtomach: but at the ſame time, the action of theſe muſcles, however forcible their contraction, cannot alone cauſe vomiting; nor has this action any tendency to produce ſuch an effect on other occaſions in which the utmoſt contraction of the diaphragm and abdominal muſcles is required to the compreſſion of the viſcera. Many have conceived that vomiting is entirely the effect of the action of the abdominal muſcles and diaphragm. Such, for example, has been the opinion not only of J. Hunter, but of

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* See Wepfer de Cicuta Aquatica, p. 68.—Sauvage's Vomitus.

Duverney, and of M. Chirac in Hiſt. de l'Acad. des Sciences, 1700. M. Littre oppoſed this notion, and contended before the Academy, that the contraction of the diaphragm was the principal cauſe of vomiting. M. Lieutaud in 1752 ſupported the idea that vomiting is the effect of the action of the ſtomach. He found, upon diſſection, in a patient whoſe ſtomach had reſiſted every kind of emetic, that it was greatly diſtended and become inſenſible; and concluded that the want of action in the ſtomach, and conſequent loſs of the power of vomiting, was a ſtrong proof of the action being the effect of the contraction of the ſtomach only. There are other more curious inſtances of diſeaſe of the ſtomach preventing the muſcular contraction in any violent degree, and conſequently the abſence of the uſual ſymptom of vomiting:—an inſtance of this kind will be ſeen in Dr. Stark's work. In my Muſeum, Surgeons' Square, there is a preparation of a ſtomach, in which the walls had become ſo thick that they could no longer ſuffer contraction by the muſcular fibres; the conſequence of which was that, although the inner coat of the ſtomach was in a raw and ulcerated ſtate, there was no active vomiting.

The ſingultus ſeems the partial exertion of the ſympathy betwixt the upper orifice of the ſtomach and the diaphragm, by which a kind of weak ſpaſmodic action is excited in it, but without a concomitant inverted action in the ſtomach and œſophagus. It is a convulſive and ſonorous inſpiration, owing to an irritation of the upper orifice of the ſtomach and œſophagus, but not exactly of that kind which cauſes inverſion of the natural actions of the ſtomach. Thus we have the hoquet des gloutons, the ſingultus, from ſome medicines and poiſons, from ſome crude aliment, or even from ſome foreign body ſticking low in the œſophagus, or from inflammation. The bourborigmi and rumination ſeem to be gentler inverted actions of the upper orifice of the ſtomach and œſophagus, unaſſiſted by any great degree of compreſſion of the ſtomach by the abdominal muſcles and diaphragm.

The full action of vomiting is preceded by inſpiration, which ſeems a proviſion againſt the violent excitement of the glottis, and the danger of ſuffocation from the acrid matter of the ſtomach entering the wind-pipe; for by this means the expiration and convulſive cough accompanying or immediately following the action of vomiting, frees the larynx from the ejected matter of the ſtomach. But the action of the diaphragm is farther uſeful by acting upon the mediaſtinum, which embraces the œſophagus, and no doubt ſupports it in this violent action.

NERVOUS OR VASCULAR COAT OF THE STOMACH.

WHAT Haller calls the nervous coat, is the cellular ſtructure in which the veſſels and nerves of the ſtomach ramify and divide into that degree of minuteneſs which prepares them for paſſing into the innermoſt or villous coat. It may with equal propriety be called the nervous, the vaſcular, or the great cellular coat *. Taking it

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* To call it cellular coat, however, would be to confound it with the three cellular coats generally enumerated by authors.

as the third diſtinct coat of the ſtomach, it is connected with the muſcular coat by the SECOND CELLULAR coat, and with the villous coat by the THIRD CELLULAR coat. Strictly, however, it is the ſame cellular membrane, taking here a looſer texture to allow of the free interchange and ramification of veſſels. When macerated, it ſwells and becomes like fine cotton, but has firmer and aponeurotic-like filaments interſecting it, and it can be blown up ſo as to demonſtrate its cellular ſtructure *. It is in this coat that anatomiſts have found ſmall glandular bodies lodged, eſpecially towards the extremities or orifices of the ſtomach.

VILLOUS COAT.—This is the inner coat, in which the veſſels are finally diſtributed and organized to their particular end. It is of greater extent than the outer coats of the ſtomach; which neceſſarily throws it into folds or plicæ. Theſe folds take, in different animals, a variety of forms: but they are ſimple in man; from the œſophagus they are continued in a ſtellated form upon the orifice, but form no valve here. In the body of the ſtomach they are more irregular, ſometimes retiform, and ſometimes they form circles or ſquares, but they have generally a tendency to the longitudinal direction. In the pyloric orifice the villous coat forms a ring, called the valve of the pylorus, which, however, has no reſemblance to a valve in its form or action. This ring is not formed by the inner coat of the ſtomach alone, but by the inner ſtratum of fibres of the muſcular coat, the vaſcular and cellular coats, and

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* Winſlow, ſect. viii. p. 64.

the inner or villous coat. The effect of all theſe coats, reflected inward at the lower orifice, is to form a tumid and pretty thick ring, which appears like a perforated circular membrane when the ſtomach has been inflated and dried; but in neither ſtate is its direction oblique ſo as to act as a valve. It ſeems capable of reſiſting the egreſs of the food from the ſtomach, or the return of the matter from the duodenum, merely by the action of the circular fibres which are included in it.

On the ſurface of the inner coat of the ſtomach, ſmall retiform rugæ and a pile of innumerable villi are obſerved. But this ſtructure of the ſtomach has not been ſo fully examined, and is not ſo perfectly underſtood as the analogous appearance in the inteſtines. Glands are alſo deſcribed as opening upon the inner ſurface of the ſtomach: and thoſe who have not been able to ſee theſe glands, which are ſeated in the third cellular coat, yet believe in their exiſtence from analogy; while others obſerve foramina toward the upper and lower orifice of the ſtomach, which they ſuppoſe to be the opening or ducts of glands. Theſe, however, which I believe to be merely cryptæ or follicles, are themſelves the ſecreting ſurface, and not the ducts of the proper round glandular bodies; at the ſame time it muſt be admitted that diſeaſe, as if magnifying and giving ſize to the ſtructure of the ſtomach, ſhews a glandular and tuberculated ſtructure.

Gastric fluid. There is ſecreted into the ſtomach a fluid, which is the chief agent in digeſtion. The moſt common opinion is that it flows from the extreme arteries of the villous coat in general, partly from the mucous cryptæ and ducts *. When pure, it is a pellucid, mucilaginous liquor, a little ſalt and brackiſh to the taſte like moſt other ſecretions, and having the power of retarding putrefaction and diſſolving the food. It acts on thoſe ſubſtances which are nutritious to the animal, and which are peculiarly adapted to its habits. It has, conſequently, ſome variety of properties in different animals. The ſecreting powers of the ſtomach ſeem ſo far to accommodate themſelves to the food received into it, that the property of the gaſtric fluid is altered according to the nature of the food. This affords another argument in favour of a ſimple diet; ſince, in a variety of condiments received promiſcuouſly into the ſtomach, the chance is the greater of ſome ingredient becoming an offenſive load.

It ſeems to be a peculiarity in the human ſtomach, that it has a greater capacity for digeſting a variety of animal and vegetable bodies. But I ſhould at the ſame time conceive that the natural power of digeſting the ſimple and appropriate food is diminiſhed as the ſtomach gains the power of diſſolving a variety of ſubſtances. In other creatures, a ſudden change of food is rejected, and the powers of the ſtomach are found incapable of acting duly on the aliment, though time ſo far accommodates the gaſtric fluid to the ingeſta that the animalization becomes perfect. Mr. Hunter ſpeaks of the power of

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* But I ſhould conſider theſe glands rather as analogous to the mucous follicles of the œſophagus and lower portion of the inteſtine, and merely as lubricating and defending the paſſages.

cattle eating and digeſting their ſecundines *. I have known a cow die from this; the membranes being found coiled up within the bowels. But the fact is ſufficiently aſcertained, that the nature of the digeſtive proceſs may be ſo far altered that gramenivorous animals may be made to eat fleſh, and carnivorous animals brought to live upon vegetables. This fact throws us back from the ſimple idea which we ſhould be apt to entertain of the nature of the change produced by digeſtion, viz. that it is ſimply chemical. For we ſee that the nature of the ſolvent thrown out from the ſtomach, and its chemical properties, may be changed by an alteration in the action of the coats of the ſtomach. Thus we are baffled in our inquiries, and brought back to the conſideration of this living property, which can ſo accommodate itſelf to the nature of the aliment.

The gaſtric fluid has been collected from the ſtomachs of animals after death, by ſponges which the animal has been made to ſwallow, or which have been thruſt down into its ſtomach, incaſed in perforated tubes. And, laſtly, it has been obtained by exciting the animal to vomiting, when the ſtomach was empty; for the ſecretions of the ſtomach are then poured out unmixed with food †. Although by theſe means a fluid may be obtained which may properly be called the ſuccus gaſtricus, yet it muſt contain a mixture of the ſaliva, and ſecretions from the glands of the œſophagus and pharynx, with the glandular ſecretions of the ſtomach, and the general vaſcular ſecretion from

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* See Obſervations on Digeſtion.

† By Spallanzani.

the ſurface of the ſtomach. It is a fluid, then, upon which the chemiſt can operate with no hope of a ſucceſsful or uniform reſult. And indeed chemiſtry ſeems no farther to aſſiſt us in forming an accurate conception of the changes induced upon the fluids in the alimentary canal, than that the more perfect, but ſtill very deficient, experience of the modern chemiſt ſucceſsfully combats the ſpeculations of the chemiſts of former ages. For example; it was formerly ſuppoſed that digeſtion was a fermentation, and that this fermentation was communicated and propagated by the gaſtric juice. It is now found that the gaſtric juice has properties the reverſe of this; that it prevents the food from taking an acid or putrefactive fermentation; that it acts by corroding and diſſolving the bodies received into the ſtomach; and that it is itſelf at the ſame time converted into a new fluid, diſtinct in its properties [*]. It is almoſt ſuperfluous to obſerve, that the gaſtric juice has no power of acting upon the coats of the ſtomach during life; whether this be owing to the property, in the living fibre, of reſiſtance to the action of the fluid, or that there is a ſecretion bedewing the ſurface,

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[*] The moſt curious fact is that property of the coats of the ſtomach, or of the fluids lodging in the coats of the ſtomach, by which milk and the ſerum of the blood are coagulated. It has been found that a piece of the ſtomach will coagulate ſix or ſeven thouſand times its own weight of milk. This action ſeems a neceſſary preparation for digeſtion, which ſhews us that the moſt perfect and ſimply nutritious fluid is yet improper, without undergoing a change, to be received into the ſyſtem of veſſels. For example; milk and the white of eggs are firſt coagulated, and then paſs through the proceſs of digeſtion. See J. Hunter, Animal Œconomy, Obſervations on Digeſtion.

face, which prevents the action, it is not eaſy to ſay; but more probably it is owing to the reſiſtance to its action inherent in a living part.

OF DIGESTION. By trituration and maſtication, and the union of the ſaliva with food in the mouth, it is merely prepared for the more ready action of the ſtomach upon it. No farther change is induced upon it than the diviſion of its parts and the forming of a ſoft pulp. But in the ſtomach, the firſt of thoſe changes (probably the material one) is performed, which by a ſucceſſion of actions fits the nutritious matter for being received into the circulation of the fluids of the living body, and for becoming a component part of the animal. For now the gaſtric juice acting on this fluid maſs quickly diſſolves the digeſtible part, and entering into union with it produces a new fluid, which has been called chyme. The maſs has changed its ſenſible and chemical properties; it has ſuffered the full action of the ſtomach, and by the gradual and ſucceſſive muſcular action of the ſtomach it is ſent into the duodenum. The contents of the ſtomach conſiſt of air (partly ſwallowed, partly extricated by chemical change, but ſtill more in all probability by the heat); of chyme; and of a groſſer part incapable of becoming nutritious, and the ſeparation of which from the chyme is accompliſhed by the action of the canal. Now the ſtomach being ſtimulated by fulneſs, by flatus, and more ſtill by the peculiar irritation of the food to which it is natural to ſuppoſe its ſenſibility is adapted, the muſcular coat is brought into action, and the contents of the ſtomach delivered into the duodenum. Here having additional ingredients, it is farther changed in its nature, and approximates more to that of the fluids circulating in the veſſels. It is called chyle; it has become a white milky fluid, which by the property of the living ſurface of the villous coat is ſeparated from the maſs, and abſorbed by the lacteal veſſels of the inteſtines *.

Hunger and thirst. We are ſolicited to take food by the uneaſy ſenſation of hunger, and by the anticipation of the voluptuous ſating of the appetite, and by the pleaſures of the palate. Hunger is conſidered as the effect of the attrition of the ſenſible coats of the ſtomach upon each other by the periſtaltic motion of the ſtomach and compreſſion of the viſcera. This appears to be too mechanical an explanation. If the ſenſation proceeded merely from ſuch attrition of the coats of the ſtomach, food received into the ſtomach would be more likely to aggravate than to aſſuage the gnawing of hunger; to excite the action of the ſtomach would be to excite the appetite, and an irritable ſtomach would be attended with a voracious deſire of food. Something more than mere emptineſs is required to produce hunger. There appears to be a deficiency of the due ſtimulus to the ſtomach, and a conſequent uneaſy ſenſation which is allayed by fulneſs. Hunger does not appear to be occaſioned by ſtimulus, but by a want of due excitement, by which the irritability of the coats and action of the veſſels are as it were ſuffered to accumulate; and this tenſion, and irritation, and fulneſs of veſſels, is relieved by the food,

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* See farther of the lacteal and abſorbent ſyſtem.

which excites the action, draws out the fluids, and gives activity to the ſyſtem of veſſels.

THIRST is ſeated in the tongue, fauces, œſophagus, and ſtomach. It depends on the ſtate of the ſecretions which bedew theſe parts, and ariſes either from a deficiency of ſecretion or from an unuſually acrid ſtate of it. It would appear to be placed as a monitor calling for the dilution of the fluids by drink, when they have been exhauſted by the fatigue of the body and by perſpiration, or when the contents of the ſtomach require a more fluid ſtate,—the more eaſily to ſuffer the neceſſary changes of digeſtion.

The cardiac orifice is the chief ſeat of all ſenſations of the ſtomach both natural and unuſual, as it is the moſt ſenſible part of the ſtomach. Indeed we might preſume this much by turning to the deſcription and plates of the nerves; for we ſhall find that this upper part of the ſtomach is provided in a peculiar manner with nerves, the branches of the par vagum.

The ſympathy of the ſtomach with the reſt of the inteſtinal canal, the connection of the head and ſtomach in their affections, the effect of the diſorder of the ſtomach on the action of the vaſcular ſyſtem and of the ſkin, and the ſtrict conſent and dependence betwixt the ſtomach and diaphragm and lungs, and in a particular manner with the womb, teſticle, &c.—and again, the connection of the ſtomach with the animal œconomy, as a whole,—muſt not eſcape the attention of the ſtudent of medicine.

SECTION III.

OF THE SMALL INTESTINES.

THE ſmall inteſtines are deſcribed as that part of the inteſtinal canal which is betwixt the pyloric orifice of the ſtomach and the valve of the colon. They are reckoned in length at four or five times the height of the body: they form that part of the canal in which the digeſtion is completed, and the nutritious fluids abſorbed from the waſte of the ingeſta. They are commonly ſubdivided into the duodenum, jejunum, and ileon; or more ſimply into the duodenum and inteſtinum tenue *.

OF THE DUODENUM.

THE DUODENUM ſtands diſtinguiſhed from the general tract of the ſmall inteſtines by its ſhape, connections, and ſituation. It is greatly larger than any other part of the ſmall inteſtines; irregularly circular; more fleſhy; and, although it has fewer plicæ, it is more glandular and more vaſcular: but its greateſt peculiarity, and that which muſt convince us of its importance in the animal œconomy, and of the neceſſity of attending to it in diſeaſe, is this, that it is the part which receives the biliary and pancreatic ducts, and in which a kind of ſecond ſtage of digeſtion takes place; and that by the diſorder of theſe ſecretions it muſt be primarily affected. The duodenum takes a courſe acroſs the

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* Haller.

ſpine from the orifice of the ſtomach until it touches the gall-bladder. Firſt it goes in a direction downward; then it paſſes upward till it touches the gall-bladder; then making a ſudden turn it deſcends directly near to the right kidney, and is then involved in the lamina of the meſocolon; it then takes a ſweep towards the right ſide, obliquely acroſs the ſpine, and a little downward; it afterwards runs behind the head of the pancreas and the great veſſels paſſing to the ſmall inteſtines betwixt the vena cava and the vena portæ; and then again toward the left of the aorta, but ſtill bound down by the root of the meſocolon *. This portion of the inteſtine receives its name from being uſually meaſured off twelve fingers breadth, or from five to ſix inches, from the orifice of the ſtomach. I have always preferred, however, a natural and not an arbitrary diviſion, and have conſidered that portion of the inteſtines as duodenum, which is above the lower lamina of the meſocolon, or the point at which it emerges from the ſtricture of the meſocolon. As in this extent, beſides being tied down to the ſpine by the meſocolon, it has the peritoneum reflected off from it at other points, we have to remark the ligamentum duodeni renale, ligamentum duodeni hepaticum.

Although we ſhall preſently treat of the coats of the ſmall inteſtines in general, yet it may not be improper here to obſerve what are announced as peculiarities in the

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* How comes it then, ſeeing the acute turns of this inteſtine, that Ruyſch calls it "Inteſtinum digitale, vel inteſtinum rectum breviſſimum?" Adverſar. Anat. Decad. II.

See a good deſcription of the duodenum by M. Laurent Benazzoli, in the Tranſactions of the Academy of Bologna.

the coats of this firſt diviſion. The firſt or peritoneal coat is imperfect, as muſt already be underſtood: for it does not inveſt the whole circumference of the gut; it ties it down more cloſely, or it merely contains it in its duplicature, while a greater profuſion of cellular membrane accompanies this than the other diviſions of the inteſtines. The muſcular coat is ſtronger than that of the jejunum and ileon; the plies formed by the inner coats, ſmaller than thoſe of the other part of the ſmall inteſtine, and having more of a glandular ſtructure. At the lower part of the firſt incurvation of the duodenum, the inner coat forms a particular proceſs like to thoſe which are called valvulæ conniventes; and in this will be diſcovered the opening of the biliary duct, within which alſo the ductus pancreaticus generally opens.

It is not without ſome reaſon that anatomiſts have conſidered the duodenum as a ſecond ſtomach, calling it ventriculus ſecundus, and ſuccenturiatus; for there is here performed a change upon the food, converting the chyme, (as they have choſen to call it,) which is formed in the ſtomach, into perfect CHYLE. But to ſuppoſe that the chyme is perfected in the duodenum, is to ſuppoſe the biliary and pancreatic ſecretions neceſſary to the formation of chyle; a point which is not allowed: for many ſuppoſe that the bile is merely a ſtimulus to the inteſtines, holding a controul over their motions; others, that it is uſeful only in ſeparating the chyle from the excrement; or again, that the bile is decompoſed, part entering into the compoſition of the chyle, while the other goes into that of the fæces: it ſeems to beſtow upon them a power of ſtimulating the inteſtinal canal in a greater degree; and as the chyle is formed occaſionally without the preſence of bile, we may be induced the more readily to allow that the bile does not in the natural actions and relations of the ſyſtems enter into the compoſition of the chyle. At all events, we ſee that it is the bile which is the peculiar ſtimulus of the inteſtinal canal, and that when interrupted in its diſcharge from the ducts, the motions of the belly are ſlow, and coſtiveneſs is the conſequence.

We ſee, then, that at all events there are poured into the duodenum from the liver and pancreas, ſecretions which have an extenſive effect on the ſyſtem of the viſcera; and we muſt acknowledge that the derangement of theſe ſecretions muſt operate as a very frequent and powerful cauſe of uneaſineſs, and that the duodenum muſt often be the ſeat of diſeaſe and diſtreſſing ſymptoms. We may obſerve that, from the courſe of the duodenum, pain in it ſhould be felt under the ſeventh or eighth rib, paſſing deep, ſeeming to be in the ſeat of the gall-bladder, and ſtretching towards the right hypochondrium, and to the kidney, and again appearing as if on the loins. We may obſerve farther, that from the connections of this portion of the inteſtine, and from the manner in which it is braced down by the meſocolon, ſpaſm, when flatus is contained in it, will ſometimes produce racking pains. Nay farther, when the irregularities of digeſtion affect the duodenum, and ſpaſm and diſtention follow; the diſtention cauſes it to preſs upon the gall-bladder, and the preſſure and the excitement together cauſe an irregular and often an immoderate flow of bile, which with the acrid ſtate of the food produces anxieties and increaſed pain, inverted motion, vomiting, and even cholera *.

We muſt not forget, that the inverted action of the ſtomach draws quickly after it the inverted motion of the duodenum. It may be of conſequence to attend to this in the operation of an emetic, for the ſtomach will ſometimes appear to be diſcharging foul and bilious matter which we naturally may ſuppoſe to have been lodged in it, but which has actually flowed from the duodenum, or has even come recently from the ducts in conſequence of the operation of the vomit †.

From a defect in the natural degree of the ſtimulating power of the bile, it will accumulate in the duodenum, occaſioning anxiety and loſs of appetite, and even congeſtion of blood and a jaundiced ſkin; we may certainly affirm that theſe at leaſt are often connected. Such accumulation in the duodenum muſt be attended with a languid action of the whole canal, and inactivity of the abdominal viſcera, becauſe the periſtaltic motion is begun here in the natural action of the inteſtines; and if its peculiar ſtimulus be deficient, ſo muſt that of the whole ſyſtem of the viſcera. Hence the neceſſity of rouſing and evacuating the whole canal.

I may farther obſerve, that it has been the opinion of the moſt reſpectable old phyſicians, thoſe whoſe

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* Indeed vomiting in conſequence of concuſſion and compreſſion upon the whole contents of the abdomen, and in a particular manner on the liver, affords moſt powerful means of operating upon the infarction and remora of the blood in the hepatic ſyſtem.

† See Sandifort, vol. iii. p. 288. See Hoffman.

knowledge of diſeaſes has been drawn from an acquaintance with anatomy, from the frequent inſpection of dead bodies, and the obſervation of the ſymptoms during life, that the ſtudy of the diſeaſes connected with the duodenum is the moſt important which can occupy the attention of the medical enquirer.

OF THE SMALL INTESTINES IN GENERAL.

The ſmall inteſtines, under the name of jejunum and ileon, occupy the ſpace in the middle and lower part of the abdomen, the great maſs forming convolutions in the umbilical region. The cylindrical canal of the ſmall inteſtines is gradually and imperceptibly diminiſhed in diameter as it is removed from the lower orifice of the ſtomach; ſo that the termination of the ilion in the caput coli is conſiderably ſmaller than the duodenum. This tract of the ſmall inteſtines performs the moſt important function of the chylipoëtic viſcera (if any can be ſaid to be peculiarly important where the whole is ſo ſtrictly connected); for here the food is moved ſlowly onward through a length of inteſtine more than four times the length of the body *, and expoſed to a ſurface amazingly extended by the pendulous and looſe duplicatures of the inner coat. Here the fæces are gradually ſeparated from the chyle, and the chyle adhering to the villi is abſorbed and carried into the ſyſtem of veſſels.

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* The whole length of the inteſtinal canal is generally eſtimated at from ſix to ſeven times the length of the whole body.

The JEJUNUM * is the upper portion of the ſmall inteſtine. Its extent is two-fifths of the whole. Its convolutions are formed in the umbilical region.

The ILEON lies in the epigaſtric and ileac regions, ſurrounds the jejunum on the ſides and lower part, and forms three-fifths of the whole extent of the inteſtine from the meſocolon to the valve of the colon. The coats of the ileon are generally deſcribed as thinner and paler; the valvular projections of the inner coat leſs conſpicuous; and the mucous glands are apparent in the lower portion. The ſeveral parts however of this, which we may call the long inteſtine †, do not preſerve a very exact relation in regard to their place in the belly, but in their motions they may be drawn to the right or left, upward or downward. This however I am convinced takes place in a much leſs degree than is generally believed.

There is ſometimes found a luſus in the lower part of the ileon before it paſſes into the colon; a blind pouch or cæcum is, as it were, attached to the ilion reſembling the caput coli. I have found this in one

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* So named from its being more generally empty. Indeed the higher parts of the canal can never be diſtended, becauſe the contents paſs ſlowly and gradually and with little interruption through them; but they are in a manner accumulated below.

† We may then ſpeak of the ſmall inteſtines in general, meaning the whole tract from the ſtomach to the great inteſtine; the duodenum being the ſpace betwixt the ſtomach and the lower lamina of the meſocolon, the long inteſtine being the tract extending from the duodenum to the colon.

inſtance only. Sometimes there is more than one in the courſe of the ileon *.

MINUTE STRUCTURE OF THE SMALL INTESTINES.

We have in ſome meaſure anticipated the general enumeration and character of the coats of the inteſtines, by what has been ſaid upon the coats of the ſtomach; for we have here to diſtinguiſh the four great coats, the peritoneal, the muſcular, the vaſcular, and villous coats.

THE PERITONEAL COAT AND MESENTERY.

The peritoneal coat of the ſmall inteſtines is of the ſame nature with that of the ſtomach, liver, ſpleen, &c. It is a thin, ſmooth, pellucid membrane. On the ſurface it has a moiſture exuding from its pores; and it firmly adheres to the muſcular fibres beneath. Its tranſparency makes the muſcular fibres, blood-veſſels, and lymphatics eaſily diſtinguiſhable; and when it is diſſected or torn up, the longitudinal muſcular fibres will be found in general attached to it. Its uſe is to give a ſmooth ſurface and ſtrengthen the inteſtine, and in a great meaſure to limit the degree of this diſtention.

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* The appendices cæcales of the ileon have given birth to a curious queſtion in the pathology of hernia. See "Hernia ab ilii diverticulo." Morgagni, Adv. Anat. III. "Hernie formée par l'appendice de l'ileon." LITTRE, Mem. de l'Acad. Royale des Sciences, an 1700; Ruyſch, Palfin, &c. See caſes of anus at the groin in the Muſeum, Surgeons' Square.

The peritoneal coat of the inteſtine is continued and reflected off upon the veſſels and nerves which take their courſe to the inteſtine: or, what is the ſame thing, and indeed is the more common deſcription, the two lamina of the peritoneum which form the meſentery, after proceeding from the ſpine and including the veſſels, nerves, and glands belonging to the tract of the inteſtine, inveſt the cylinder of the inteſtine under the name of peritoneal coat *. The meſentery is compoſed of membranes, glands, fat, and the ſeveral ſyſtems of veſſels, arteries, veins, lacteals, and nerves. As in reality it is a production of the peritoneum, it may be ſaid to ariſe from the meſocolon, or the meſocolon from the meſentery, reciprocally. But at preſent we may trace the meſentery from the root of the meſocolon;—for the jejunum, emerging from under the embrace of the meſocolon, carries forward the peritoneum with it; and the laminæ of the peritoneum, meeting behind the gut, include the veſſels which paſs to it and form the meſentery. This connection of the ſmall inteſtines by means of the prolongation of the peritoneum, while it allows a conſiderable latitude of motion, preſerves the convolutions in their relations, and prevents them from being twiſted or involved. But it is by the walls of the abdomen that the inteſtines as well as the more ſolid viſcera are ſupported; for when the bowels eſcape by a wound, a portion of an inteſtine will hang down upon the thigh, unreſtrained by the connection with the meſentery.

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* See Plate I. 5. 6. 7. 8.

The meſentery begins at the laſt turn of the duodenum, or beginning of the jejunum. Its root runs obliquely from left to right acroſs the ſpine. Here it has no great extent; but as it is prolonged toward the inteſtines, it ſpreads like a fan, ſo that its utmoſt margin is of very great extent; which may be conceived when we conſider that it is attached to the whole extent of the ſmall inteſtines. In the middle of the ſmall inteſtine, the meſentery has its greateſt extent or breadth; towards the beginning of the duodenum and the termination of the ilion, it is ſhorter, and more cloſely binds down the inteſtine.

MUSCULAR COAT OF THE INTESTINES.

There is not a more important point of conſideration in the anatomy of the viſcera, than this of the action of the muſcular coat. The appearance and courſe of the fibres ſhall firſt be deſcribed, then their action, and laſtly their effect in diſeaſe.

The peritoneum is united to the muſcular coat by a very delicate and denſe cellular membrane; which in the enumeration of the coats we muſt call the firſt cellular coat, but which really does not deſerve the name of a diſtinct coat; for, as already ſaid, the outer lamina of the muſcular coat is raiſed with the peritoneum, and adheres intimately to it. The fibres of the muſcular coat of the inteſtines are ſimpler than thoſe of the ſtomach; for here there are only two ſets of fibres, the longitudinal and circular fibres. The outer ſtratum conſiſts of the very minute and delicate longitudinal fibres. Indeed, when the ſyſtem has been exhauſted by a long and debilitating illneſs with ſcarcely any excitement of the inteſtinal canal, theſe fibres are not to be obſerved. In a man who has been cut ſuddenly off by diſeaſe, or who has died a violent death, they become more demonſtrable; and in diſeaſes where there has been congeſtion and excited action in the inteſtines, they are of courſe ſtill ſtronger and more diſcernible. The internal ſtratum of the muſcular fibres is much ſtronger and more eaſily demonſtrated. Theſe fibres will be obſerved much ſtronger about the duodenum and upper part of the jejunum, but they become weaker and more pellucid towards the extremity of the ileon. Tracing any particular fibre of the circular ſtratum, it is found to form only a ſegment of a circle, a part of the circuti of the inteſtine. It ſeems loſt amongſt neighbouring fibres or cellular connections; but ſtill, taken together, the circular muſcular fibres uniformly ſurround the whole gut *.

To account for that action of the inteſtines which urges on the food, we may ſuppoſe a greater degree of irritability and activity to reſide in the upper portion, where of courſe is commenced that action which is ſucceſſively propagated downward, carrying the fæces into the lower part of the canal. Some anatomiſts have ingeniouſly imagined that the inner ſtratum of fibres ſurrounds the inteſtine not in a circular direction, as was aſſerted by Willis, but obliquely and in a ſpiral courſe; from which followed a ſimple explanation of their

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* Morgagni Adverſaria Anatomica III. Animadverſio V.

their effect, ſince the contraction of the fibre winding lower in the inteſtine purſued the contents with a uniform progreſſive conſtriction.

Phyſiologiſts have made a diſtinction in the motion which they have obſerved in the inteſtines of living animals. The one they call the vermicular, and the other the periſtaltic motion. Upon looking into the belly of a living animal, or of one newly killed, there may be obſerved a motion among the inteſtines, a drawing-in of one part and a diſtention and elongation of another part of the convolution. This motion has ſome reſemblance to the creeping undulating motion of a reptile, and has got the name of vermicular motion. On the other hand, the direct contraction of the gut by the conſtriction of the circular fibres is the periſtaltic motion. We muſt not however allow ourſelves, from the looſe expreſſion of authors, to imagine, that theſe circular ſtreight fibres act ſeparately: on the contrary, excited by the ſame ſtimulus, they have a ſimultaneous motion to the effect of accompliſhing the perfect contraction of the gut and motion of its contents *.

While the ſtimulus is natural, the contraction of the muſcular coat is in a regular ſeries from above downward, and, the lower part contracting before the upper is completely relaxed, the food muſt be urged downward into the lower portion. I ſhould even imagine that the lower portion is relaxed, from its more uſual

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* Neither can I allow that the acting of the longitudinal fibres in one portion of an inteſtine dilates that which is below, otherways than by the compreſſion of food and flatus.

degree of tenſion, or ſlighter permanent degree of action *.

ANTIPERISTALTIC MOTION.

When the ſucceſſive contraction of the muſcular fibres of the inteſtines is oppoſed in its natural courſe downward, either by a violent ſtimulus (the effect of which is to cauſe a more permanent contraction in the coats, and one which does not readily yield to the relaxation that follows, as in the natural contraction), or when there is a mechanical and obſtinate interruption to the contents of the bowels; then is the natural action reverſed. This antiperiſtaltic motion muſt ariſe thus; a portion of the inteſtine being conſtricted, and not yielding to the contraction which in the natural action of the gut ſhould follow in order, the motion of the gut muſt be ſtationary for a time, until the part above is again relaxed; when, the contents of the inteſtine finding a free paſſage upwards, and that portion contracting and propelling the matter ſtill upwards and retrograde, (ſince it is oppoſed by the contraction below,) a ſeries of retrograde or antiperiſtaltic motions are produced. The courſe of the action is changed; the contraction

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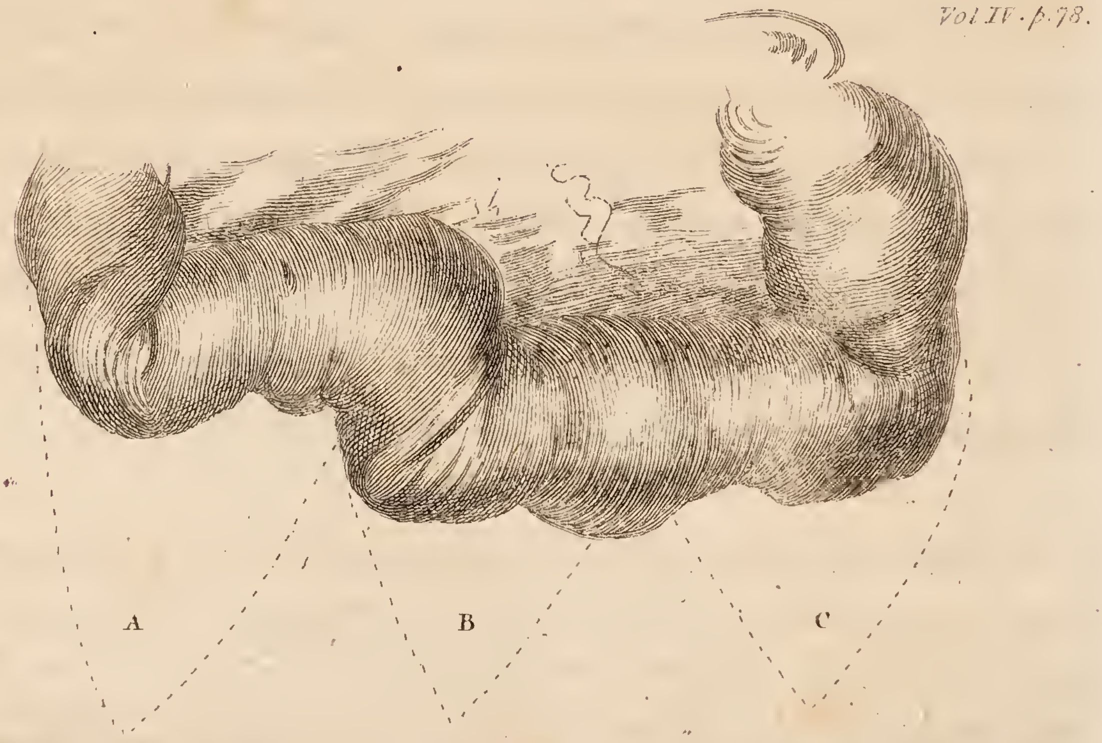
* From the experiment of Haller and of others, it is proved that the irritability of the inteſtines long ſurvives that of the heart: that the inteſtines are in general in lively motion, when no motion can be obſerved in the ſtomach: but that ſometimes the motion of the ſtomach continues longer than that of the inteſtines. It is proved alſo that the action of the inteſtine is adequate to the motion downward and the diſcharge of fæces, without the aid of the abdominal muſcles. See *Mem. par Haller ſur les Mouvemens des Inteſtines.*

of the gut is not followed by the dilatation of the part below, but by that of the part above. By this means the matter of the lower portion of the inteſtinal canal is carried into the upper part, and there acting as an unuſual ſtimulus it aggravates and perpetuates the unnatural action. Nay, from experiments it appears that a permanent irritation will cauſe an accelerated motion in both directions, that from the point ſtimulated there will proceed downward the regular ſeries of contractions and dilatations, while the motion is ſent upwards and retrograde from the ſame point of the inteſtine toward the ſtomach *. And this obſervation, the exhibition of medicine and the diſeaſes of the inteſtines confirm. But farther we may obſerve, that the food is not uniformly moved downward; it is ſhifted and agitated by an occaſional retrograde motion thus:



The portion of the inteſtine included under A contracts and ſends its contents into B. B contracting ſends its fluid contents in part backward into A, but

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* Haller, loc. cit., Exper. 424.

in a greater proportion into C. While the contents of the middle portion are ſent into the lower part in a greater proportion than into the higher diviſion, the tendency of the food will be in its natural courſe, downward; whilſt at the ſame time it ſuffers an alternate motion backward and forward; ſo that it is more extenſively applied to the abſorbing ſurface of the inteſtines.

The ſtimulus to the inteſtines is matter applied to their inner coat; and although there is much ſympathy in the whole canal, yet unleſs there be matter within a portion of the canal, that particular part has little action. Accordingly, when there is obſtruction to the courſe of the aliment, by whatever cauſe it may be produced, the portion below becomes ſhrunk and pale, and free from the effects of inflammation; while that ſtimulated by the food, being in a high ſtate of excitement, irritated by the preſence of matter which it is unable to ſend forward, evacuated only partially by an unnatural and highly excited retrograde action, it becomes large, thick in its coats, ſtrong in its muſcular fibres, and greatly inflamed, till it terminate at laſt in gangrene *.

The unuſual excitement of the muſcular fibres produces a very curious effect in the intus-ſuſceptio, or the

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* Haguenot gives an experiment illuſtrating the cauſe of ileus. He tied a ligature about the inteſtine of a cat, and found no antiperiſtaltic motion excited. This is not wonderful; it is the excitement ariſing from matter within the gut, to which there is no exit, and not the ſtricture of it, which is the cauſe of the violent ſymptoms.—A caſe in the Muſeum will give the young ſtudent a correct judgment on this ſubject.

ſlipping of one portion of the gut within another. This may be done by applying acrid matter to the inteſtines of living animals; and I have no doubt that it has been produced by giving purges too ſtrong and ſtimulating in caſes of obſtruction of the bowels. By the contractions of the muſcular coat greatly excited, the inteſtine is not only diminiſhed in diameter ſo as to reſemble an earth-worm *, but in length alſo. This great contraction of the outer coats accumulates the vaſcular and villous coat as if into a heap; which from the compreſſion of the muſcular coat is forced into the neighbouring relaxed portion. This firſt ſtep leads only to a ſucceſſion of actions; for the fibres of the relaxed or uncontracted part, ſenſible to the preſence of this accumulated and turgid villous coat, contracts in ſucceſſion ſo as to draw a part of the contracted gut within the relaxed portion. If the irritation is done away or ceaſes quickly, as in the experiments on animals, another turn of the inteſtine coming into play diſtends this, and undoes the intus-ſuſceptio. But if the cauſe continues, the intus-ſuſceptio is continued; the included part of the gut is farther forced into the other. By theſe means the veſſels going to the included part are interrupted; the villous coat ſwells more and more; and ſeveral feet of the upper portion of the inteſtine is often in this way ſwallowed down. It is not however in the natural courſe downward that this preternatural action always proceeds; for, as the excitement is violent and unlike the uſual ſtimulus of

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* See Haller's Experiments; and "Diſſections of the Atrophia Ablactatorum;" with plates; by Dr. Cheyne.

food, and as we know that an unuſual excitement is very apt to cauſe an inverted action, it often happens that the intus-ſuſception is formed by the lower portion of the gut included in the upper part.

VASCULAR COAT.

This third coat of the inteſtines, or what is commonly called the nervous coat, is a ſtratum of cellular membrane in which the veſſels of the gut are diſtributed. It might with equal propriety be called the cellular coat; and is indeed what ſome anatomiſts have called the third cellular coat. By inverting the gut and blowing ſtrongly into it, the peritoneal coat cracks and allows the air to eſcape into this coat; which then ſwells out, demonſtrating its ſtructure to be completely cellular *. Its uſe evidently is to ſuffer the arteries, veins, and lymphatics to be diſtributed to ſuch a degree of minuteneſs as to prepare them for reflection into the laſt and innermoſt coat, and for entering into the ſtructure of the villi: for they come to the extremity of the meſſentery as conſiderable branches, but forming in this coat a uniform texture of veſſels, their extreme branches are finally diſtributed to the inner coat. This is the coat in which, in ſome parts of the inteſtines, little glands or criptæ are lodged.

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* An experiment, to which Albinus attaches much importance. See alſo, in the Acad. de Bologna, a paper by Mr. D. G. Galeati on the fleſhy coat of the ſtomach and inteſtines.

VILLOUS COAT.

The moſt curious part of the ſtructure of the inteſtines is the villous or inner coat; for by its organization is the chyle ſeparated from the general maſs of matter in the bowels, and carried into the ſyſtem of veſſels. To this all we have been deſcribing is merely ſubſervient.

The villous coat has a ſoft fleecy ſurface; and being of greater extent than the other and more outward coats, it is thrown into circular plaits which hang into the inteſtine, taking a valvular form. They have the name of VALVULÆ CONNIVENTES. Some of them go quite round the inſide of the inteſtine; others only in part. They are of larger or ſmaller extent in different parts of the canal: for example; they begin a very little way from the lower orifice of the ſtomach irregularly, and tending to the longitudinal direction; further down they become broader, more numerous, and nearly parallel; they are of greater length, and more frequent in the lower part of the duodenum and upper part of the jejunum. Theſe valvular projections have their edges quite looſe and floating in the canal; and from this it is evident that they can have no valvular action. Their uſe is to increaſe the ſurface expoſed to the aliment; to enlarge the abſorbing ſurface; and at the ſame time to give to it ſuch an irregularity that the chyle may lodge in it and be detained *. Into

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* "Superficies internæ hujus tunicæ ad menſuram geometricam, aliquoties integumentorum communium ſuperficiem amplitudine ſuperat." Soemmering, vol. vi. p. 295.

the ſtructure of theſe plicæ of the villous coat, the vaſcular or cellular coat enters, and generally in the duplicature a ſmall artereal and venous trunk will be obſerved to run. That theſe plicæ are formed chiefly by the laxity of the connection and the greater relative extent of the inner coat, is apparent upon inverting the gut, and inſinuating a blow-pipe under it, for then you may diſtend the cellular ſubſtance of the vaſcular coat ſo as entirely to do away the valvulæ conniventes.

The pile or lanuginous ſurface from which this coat has its name, is to be ſeen only by a very narrow inſpection, or with the magnifying glaſs. It is owing to innumerable ſmall filaments which project from the ſurface, like hairs at firſt view, but of a flat or rounded figure as the ſtate of fulneſs and excitement or depletion ſhows them. They conſiſt (as appears by the microſcope) of an artery and vein, and lacteal or abſorbing veſſels, and to theſe we may ſurely add the extremity of the nerve. They have a cellular ſtructure; they are exquiſitely ſenſible; and, when ſtimulated by the preſence of fluids in the inteſtines, are erected, and abſorb the chyle. They are the extremities of the lacteal abſorbing ſyſtem, and their ſtructure would ſeem to be ſubſervient to the abſorption by the mouth of the lacteal veſſel *.

But the ſurface of this coat is not only an abſorbing one, it alſo pours out a ſecretion: and indeed it is as a

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* See further of their ſtructure under the title of the LACTEAL and LYMPHATIC SYSTEM, in this volume, where the ſubject of abſorption and the ſtructure of the villi is treated.

ſecreting ſurface, upon which medicines can act, that it is to us one of the moſt powerful means of acting upon the ſyſtem in diſeaſe. The fluid which is ſupplied by the ſurface of the inteſtines is called the liquor intericus; a watery and ſemipellucid fluid, reſembling the gaſtric fluid. This fluid, phyſiologiſts have affected to diſtinguiſh from the mucous ſecretion of the glands of the inner ſurface of the inteſtines; but it is impoſſible to procure them ſeparate *.

GLANDS.

Anatomiſts have obſerved ſmall mucous glands ſeated in the cellular membrane of the inteſtines †, the ducts of which they deſcribe as opening on the villous ſurface of the inteſtines. They are ſeen as little opaque ſpots, when the inteſtine is cut in its length and held betwixt the eye and the light. They have been chiefly obſerved in the duodenum; few of them in the general tract of the ſmall inteſtines. Little collections or agmina are obſerved, which increaſe in frequency toward

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* It has been ſuppoſed that the fluids excreted from the ſurface of the inteſtines were furniſhed by very minute foramina (which are viſible by particular preparation) in the interſtices of the villi. See the letter of Malpighi to the Royal Society of London on the Pores of the Stomach; and the paper by M. Galeati in the Bologna tranſactions on the Inner Coat, which he calls the Cribriform Coat. Theſe pores, according to Galeati, are viſible through the whole tract of the canal, and particularly in the great inteſtines.

† Peyruſ. Biblio. Manget. Brunnerus de glandulis duodeni. Wipfer, Morgagni, &c. Theſe he ſuppoſed additional pancreatic glands.

ward the extremity of the ileon. It is natural to ſuppoſe that as the contents of the inteſtines become in their deſcent more acrid and ſtimulating, there will be a more copious ſecretion of mucus in the lower inteſtines for the defence of the villous coat.

SECTION IV.

OF THE GREAT INTESTINES.

THE great inteſtines form that part of the inteſtinal canal which is betwixt the extremity of the ileon and the anus. They differ eſſentially from the ſmall inteſtines in their ſize, form, and general character; and in the texture, or at leaſt in the thickneſs of their coats.

The great inteſtine, beginning on the right ſide of the belly, riſes before the kidney; paſſes acroſs the upper part of the belly, under the liver, and before or under the ſtomach *. Then making a ſudden angle from under the ſtomach and ſpleen †, it deſcends into the left ileac region. Here, making a remarkable turn and convolution, it deſcends into the pelvis by a curve running in the hollow of the ſacrum.

The great inteſtines are accounted to be about ſeven feet in length, and to bear a relation to the ſmall inteſtines as five to twenty-five.

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* This turn of the colon from the right acroſs the belly is flexura prima, ſuperior dextra hipatica Soemmering.

† Flexura ſecunda, ſuperior ſiniſtra lienalis.

The natural diviſion of this portion of the inteſtine is into the cœcum, colon, and rectum *.

VALVULA COLI.

The extremity of the inteſtinum ileon enters as it were into the ſide of the great inteſtine at an angle †. And here there is a valvular apparatus formed by the inner membrane of the gut, which, more than any other circumſtance, marks the diſtinction betwixt the ſmall and great inteſtines; for as the effect of this valve is to prevent the regurgitation of the fæces into the ſmall inteſtines, it marks ſufficiently the nature of the change produced on the injeſta in their paſſage through the ſmall inteſtine, and how unfit in their acrid and putreſcent ſtate they are to be longer allowed lodgment there.

Upon opening the caput coli, or lower part of the colon, on the right ſide, and examining the opening of the ileon into it, we ſee a ſlit formed betwixt two ſoft tumid plicæ of the inner membrane of the gut: the one of theſe is ſuperior; the other inferior. They are ſoft, and moveable, and ſeem ſcarcely calculated for a valvular action. But there is little doubt that when the great gut is diſtended or in action, they are calculated to reſiſt the retrograde paſſage of the fæces

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* Some authors divide the great inteſtine into ſix parts, enumerating the cœcum; pars vermiformis; the right; the left; and the tranſverſe colon; and the laſt part or rectum.

† Of the entering of the ſmall inteſtine into the greater, ſee Morgagni Adverſar. iii. Animad. xi.

into the ileon. In the oblong opening of the ileon, and in the broadneſs of the valvular membranes, there is conſiderable variety. The ſuperior valve is tranſverſe, ſmaller and narrower than the lower one; the lower one is longer, and takes a more extenſive curve: and ſometimes the lower one is ſo remarkably larger than the upper valve, that it gives a great degree of obliquity to the inſertion of the ileon into the colon, ſo as to approach to that ſtructure which we ſee in the entrance of ducts, as the biliary duct into the inteſtine, or the ureter into the bladder. At the extremities of theſe valves they coaleſce and run into the common tranſverſe folds of the colon: and this is what Morgagni has called the fræna. At this place of union of the ilion and colon the longitudinal muſcular fibres of the ilion are mingled and confounded with the circular fibres of the colon *. The circular muſcular fibres certainly enter ſo far into the compoſition of the valve, that they embrace the margin, and, by contracting during life, muſt make the experiments on the action of this valve in the dead body leſs deciſive than they would be were we certain that this valve acts on principles ſtrictly mechanical.

The diſcovery of the valve of the colon, and which, from its action in guarding the ileon, might rather be called the valve of the ileon, has been claimed or attributed to many anatomiſts, chiefly to Varolius, Bauhin, and Tulpius; and it ſometimes receives the name of the two later anatomiſts.

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* Winſlow.

CŒCUM.

We have ſeen that the ileon is inſerted into the ſide of the colon: now that portion of the gut which is below this union of the ileon is a round or ſlightly conical ſac, from two to three inches in length. It is attached by cellular membrane to the iliacus internus muſcle. It is not a regular ſac, but is divided into large cells like thoſe in the reſt of the colon, and has conſiderable varieties in different ſubjects.

PROCESSUS, SEU APPENDIX VERMIFORMIS.

There is appended to the cœcum a ſmall gut, alſo blind; but bearing no relation in ſize or in figure to any part of the inteſtinal canal. This gut, from its ſmallneſs and twiſted appearance, like the writhing of an earthworm, has received the name of vermiformis. It is ſomewhat wider at the connection with the great inteſtine, and ſtands off obliquely, ſo that ſometimes its inner membrane takes the form of a valve[*]. It ſcarcely ever is found containing fæces, but only a mucus excreted from its glands. In the fœtus the appendix vermiformis is comparatively much larger, its baſe wider; upon the whole, more conical, and containing meconeum; and in the young child it often contains fæces.

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[*] Morgagni. M. Laur. Bonazzoli in the Acad. of Bologna.

GREAT DIVISIONS OF THE COLON.

The great diviſions of the colon (which I conceive it neceſſary to enumerate, chiefly with a view to the accurate deſcription of the ſeat of diſeaſe) are theſe: Firſt, the RIGHT DIVISION of the COLON riſes from the inſertion of the ileon, and from that part of the great inteſtine which is tied down by the peritoneum and cellular membrane, and aſcends on the right ſide of the ſmall inteſtines, until it gets under the margin of the liver, and in contact with the gall-bladder. Of courſe, this part will be found to take ſome conſiderable varieties in its form, depending upon its ſtate of diſtention.

THE TRANSVERSE COLON *.

The tranſverſe colon is that part of the great inteſtine which often takes a courſe directly acroſs the belly, but which generally forms an arch before or immediately under the ſtomach. When this part of the colon however is much diſtended, being at the ſame time held down by the meſocolon, its angular turns reach under the umbilicus, nay even to the pelvis. For the varieties in the ſituation of this inteſtine and the viſcera in general, ſee Morgagni Adverſar. Anat. ii. Animadver. ii.

The LEFT OR DESCENDING COLON is ſhort: for between the point, where the colon begins to bend down on the left ſide, and thoſe violent turns which

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* COLON TRANSVERSUM. ZONA COLI.

it takes before terminating in the rectum, is but a ſhort ſpace. It is here attached to the diaphragm and pſoas muſcle.

The SEGMOID FLEXURE of the colon * is formed by a narrowing and contraction, and cloſer adheſion of the gut to the loins below the left kidney, and to the cup of the ileum by the peritoneum, which ſeems to have the effect of throwing it into ſome ſudden convolutions. The colon then terminates in the rectum.

PECULIARITIES IN THE COLON DISTINGUISHING IT FROM THE SMALL INTESTINES.

The coats of the great inteſtines are the ſame in number and in ſtructure with thoſe of the ſmall inteſtines; but they are thinner and more difficult to be ſeparated by diſſection. The villi of the inner coat are ſmaller; the mucous glands or folicules are ſometimes very diſtinct; and, laſtly, the muſcular fibres have ſome peculiarities in their arrangement, The moſt characteriſtic diſtinction in the general appearance of the great and ſmall inteſtines, is the notched and cellular appearance of the former. The cells of the colon, being formed betwixt the ligamentous-like ſtripes which run in the length of the gut, have a regular threefold order. Theſe cells give lodgment to the fæces; retain the matter; and prevent its rapid deſcent or motion to the rectum. Here the fluids are ſtill more exhauſted, and the fæces take often the form of theſe cells. When the great inteſtines are torpid, and inert

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* From its reſembling the Roman S.

in their motions, the fæces remain too long in the cells of the colon, and become hard balls or ſcibulæ. But when in this ſtate of coſtiveneſs the inteſtines are excited by medicine, not only is the periſtaltic motion of the inteſtines increaſed, but the veſſels pour out their ſecretions, looſening and diſſolving the ſcibulæ [*].

MUSCULAR COAT.

The ligamentous-like bands of the colon form three faſciculi running in the length of the gut: one of theſe, obſcured by the adheſion of the omentum, is not ſeen without diſſection; and the other is concealed by the meſocolon [†]. Theſe bands are formed by the longitudinal fibres of the gut, being concentrated into faſciculi, and not uniformly ſpread over the general ſurface, as in the ſmall inteſtines: and being at the ſame time more firmly connected with the peritoneal coat, they give the appearance outwardly of ligament more than of muſcular fibres [‡]. The inner or circular muſcular fibres of the great inteſtines are like thoſe of the ſmall inteſtines, uniformly ſpread over their ſurface, and are ſtronger than thoſe of the latter.

Fæces. That the food digeſted, in part abſorbed, and its fluids exhauſted, becomes fæces in its progreſs through the inteſtines, will be univerſally allowed:

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[*] See note of the pores of the inteſtines.

[†] Stratum liberum, ſtratum omentale & tertium Meſocolicum. Soemmer, § ccxxx.

[‡] See Morgagni. See alſo Galeati on the fleſhy coat of the ſtomach and inteſtines, in the Memoirs of the Acad. of Bologna.

but how much of the excrementitious matter in the colon is a human ſecretion is not equally attended to. Men who have died of want, and men exhauſted by long fever or other diſtreſs, and who did not or were incapable of taking nouriſhment, have had diſcharges of fæces; and fæces are found in their inteſtines upon diſſection. The fœtus has the inteſtines filled with miconium *. The effect of a purge is not only to ſtimulate the inteſtines to throw off their contents, but the inner ſecreting ſurfaces pour out their fluids. The ſurface of the inteſtines is not only calculated to abſorb nouriſhment, and capable of throwing off the fluids from the ſyſtem, like the kidneys in ſecreting the urine, but it ſeems deſtined in a particular manner to carry off the earthy parts of the body, which in the circle of actions is alternately undergoing renovation and decay. Thus the fæces conſiſt of the food and chyme, which has not been converted into chyle and abſorbed, but which has been decompoſed, and has entered into new combinations; it is united to part of the bile, which has alſo been decompoſed; to the ſecretion of the pancreas; to the ſecretion of the immenſe extent of ſurface of the inteſtines; and many ſubſtances are found in the excrements which did not exiſt in the food. From the ſame ſources (viz. the ſecretions poured into the inteſtinal canal, or directly from its ſurface) are formed concretions, often of an enormous ſize; often diſtinct from the nature of the more common biliary ſecretions †; and ſometimes theſe earthy

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* See Haller Phiſ. Elem. tom. vii. ſect. 6. § 3.

† Haller loc. cit.

depoſits entering into the compoſition of the fæces, give to them a ſtoney hardneſs.

RECTUM.

The RECTUM forms the laſt diviſion of the great inteſtines; and I know no better proof of the impracticability of altering the names in anatomy than this, that anatomiſts have, in almoſt every age, inſiſted on the impropriety of calling this gut, which anſwers in its ſhape to the curve of the ſacrum, a ſtraight gut; and yet always, and to the preſent day, it is rectum.

From the laſt turns of the colon, called ſegmoid, the gut is continued over the promontory of the laſt vertebra and ſacrum (a little to the left ſide), and falls into the pelvis. It runs down, in a curved direction, betwixt the ſacrum and bladder of urine. In the upper part it is covered by the peritoneum, and has its fatty appendages like the colon, but leſs regular; and ſometimes the fat merely depoſited under the peritoneal coat. It is tied down by the peritoneum, in form of meſo-rectum; but, deeper in the pelvis, it loſes the peritoneum (which, as we have ſaid, is reflected up upon the back of the bladder, and forms here lateral folds), and the rectum is connected with the lower part of the bladder and veſſiculæ ſeminalis by cellular membrane. In women, the muſcular fibres of the rectum and vagina are intimately connected [*].

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[*] Winſlow.

The muſcular coat of the rectum is particularly ſtrong. The fleſhy bands of the colon, ſpreading out, are continued down upon the rectum in an uniform ſheath of external longitudinal fibres. The circular fibres of this part of the gut are alſo particularly ſtrong; and towards the extremity, appearing in ſtill ſtronger faſciculi, they obtain the name of ſphincter, of which three are enumerated: and this, to diſtinguiſh it from the others, is called the inteſtinal or orbicular ſphincter.

The internal coat of the rectum does not deſerve the name of villous, nor of papillaris. Its ſurface is ſmooth, and there are often diſtinctly ſeen little foramina like the mouths of ducts or folicules, in part the ſource of the mucous diſcharge, which is ſometimes poured out from this gut. Towards the anus the fold becomes longitudinal, and terminates in the notched-like irregularities of the margin.

CHAP. III.

OF THE SOLID OR GLANDULAR VISCERA OF THE ABDOMEN.

SECTION I.

OF THE LIVER.

OF ITS SEAT, AND CONNECTIONS BY LIGAMENTS, AND OF THE DIVISIONS APPARENT ON ITS SURFACE.

OUR attention is now naturally drawn to the liver, as it holds, in ſo eminent a degree, the ſovereignty over the motions of the inteſtinal canal, and as it is ſo ſtrictly connected with it by its ſyſtem of veſſels, and by its functions. The liver is the largeſt viſcus in the body, and as in its ſize and proportion to the whole body it is great, ſo are its connections in other reſpects with the whole ſyſtem very intimate. This is particularly evident in the diſeaſes of the liver, and was the cauſe of the ancients aſcribing to it ſo eminent a place in the œconomy.

FUNCTION OF THE LIVER.—In all ages authors have paid particular attention to the liver, and have exerciſed their ingenuity in giving various explanations of its function. The ancients made it the ſupreme director of the animal ſyſtem. They ſuppoſed that they could trace the nutritious fluids of the inteſtines through the meſeraic veins into the porta and into the liver, and that it was there concocted into blood. From the liver to the right ſide of the heart they found the cava hepatica, carrying this blood formed in the liver to the centre of the ſyſtem: and through the veins they ſuppoſed the blood to be carried to the remote part of the body.

The liver is the largeſt glandular body of the whole ſyſtem. Its uſe is to ſecrete the bile, which is carried into the inteſtines, and performs there an eſſential action on the food while paſſing in the tract of the inteſtines.

SEAT OF THE LIVER.—The liver is ſeated in the upper part of the abdomen, under the margin of the ribs, and towards the right ſide, or in the right hypochondrium. In the fœtus it occupies more of the left ſide than it does in the adult. Indeed it is nearly equally balanced in the fœtus, but the older the animal (or at leaſt for the five firſt years) the greater will be the proportion of it found lodged in the right ſide.

Without going into the more minute ſubdiviſions of this viſcus, we may obſerve, that it is more uniform, and ſmooth, and convex on the upper ſurface; on the lower, more irregularly concave. Its upper ſurface is applied in cloſe contact to the concavity of the diaphragm, and in the fœtus its margin is in contact with the abdominal muſcles, becauſe it falls lower than the margin of the ribs. Its lower and concave ſurface receives the convexity of the ſtomach, duodenum, and colon. In a healthy adult ſubject the liver does not extend from under the margin of the ribs, unleſs near the pit of the ſtomach, but in the fœtus and child it is much otherwiſe. In a fœtus of the third and fourth month the liver almoſt fills the belly; it reaches to the navel, covers the ſtomach, and is in contact with the ſpleen. After the ſeventh month other parts grow with a greater rapidity in proportion. Indeed ſome have affirmed, that the liver, or at leaſt the left lobe, actually decreaſes towards the time of birth *. But from this time to the advance to manhood the cheſt becomes deeper; the ſternum is prolonged; and the diaphragm becomes more concave; ſo that the liver retires under the margin of the ribs, and its margin on the left ſide in the adult reaches no farther than to the œſophagus. When however the liver becomes ſchirrous and enlarged, its hard margin comes down ſo as to be felt through the abdominal pariës under the border of the cheſt. This enlargement of the liver, and conſequent deſcent of its margin, is to be felt more eaſily by graſping the integuments of the belly, as if you expected to lift up the acute edge of the liver, than by preſſing with the point of the finger. By this means we ſhall be ſenſible of the elaſticity and ſoftneſs below the liver, and of the reſiſtance and firmneſs of the margin of it. The phyſician, however, ſhould not forget, that the depreſſion of the diaphragm, and conſequent protruſion of the liver by diſeaſe in the thorax, gives the feeling of an enlargement and hardening of the liver. The left great diviſion of the liver is perhaps as

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* M. Portal, Acad. de Sciences, 1773.

often diſeaſed and enlarged as the right, in which caſe it is more difficult to aſcertain it by examination, and it muſt be learnt from other circumſtances beſides the actual touch.

Neither ſhould a phyſician be ignorant, that by ſuppuration in the lungs, and conſequent riſing of the diaphragm, the liver is elevated conſiderably, ſo as to retire farther under the protection of the falſe ribs *.

M. Portal, by running ſtilettos into the belly of the ſubject as it lay upon the table, or was raiſed into the perpendicular poſture, found that in the latter poſture the liver ſhifted two inches. But it is almoſt ſuperfluous to remark concerning theſe experiments, that they are by no means concluſive. In the dead body, the abdominal muſcles are relaxed; they yield to the weight of the viſcera; and the diaphragm is pulled down by the weight of the abdominal viſcera. The margin of the liver neceſſarily falls lower, but in the living body there is a cloſe and perfect bracing of every part by the abdominal muſcles; they do not yield, and very little if any alteration can take place in the ſituation of the viſcera.

It muſt be obſerved, however, that a conſiderable motion of the liver is the effect of reſpiration, and of the action of the diaphragm. This motion is chiefly on the back part of the right lobe of the liver. The left lobe being more on the centre of the belly, and conſequently oppoſite to the centre and leſs moveable part of the diaphragm, it is leſs affected by the reſpiration than the larger right lobe.

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* Theſe obſervations in detail belong to another place.

LIGAMENTS OF THE LIVER.

The peritoneum is reflected in ſuch a manner from the neighbouring parts upon the liver as to form membranes receiving the name of ligaments. It has been explained, however, that theſe are not the ſole ſupport of this viſcus; and that the compreſſion of the ſurrounding abdominal muſcles is the principal ſupport of the liver, as it is of the other viſcera.

The BROAD LIGAMENT* of the liver is formed by two lamina of the peritoneum, connected by their cellular membrane, deſcending from the middle of the diaphragm and point of the ſternum to the convex upper ſurface or dorſum† of the liver. This ligament is broadeſt where it paſſes down from the point of the ſternum to the foſſa umbilicalis; but as it retreats backward it becomes narrower, and is united to the coronary ligament near the paſſage of the vena cava. This circumſtance, with the curve which it naturally takes on the ſurface of the liver, gives it the ſhape of the falx, as it is formed by the dura mater.

LIGAMENTUM TERES. The round ligament of the liver is the firmer ligamentous-like cord, which may be traced from the umbilicus along the peritoneum into the duplication of the broad ligament, and into the foſſa umbilicalis. It is formed by the degenerated coats of the great vein which brings the florid blood from the placenta into the veins of the liver, and from thence conveys it into the right ſide of the heart of the fœtus *.

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* Ligamentum latum ſuſpenſorium, falciforme.

† See Plate I. of this volume.

THE CORONARY ligament of the liver is formed in conſequence of the attachment of the liver to the diaphragm. The attachment is of courſe ſurrounded by the inflection of the peritoneum from the diaphragm to the liver. It is called the coronary ligament, though it has been obſerved, that this attachment of the liver is not circular, but of an oval, and very oblong ſhape. It appears, that it is this cloſe adheſion of the liver to the diaphragm, which is the occaſion of the ſympathy of the diaphragm in diſeaſe of the liver, and the cauſe of the pain felt in the ſhoulder and neck from inflammation, and ſuppuration in the liver, in conſequence of the courſe and connections of the phrenic nerve.

The LATERAL LIGAMENTS are formed by the peritoneum continued laterally. The right lateral ligament, like a meſentry, attaches the right and great lobe of the liver to the diaphragm, and the left lateral ligament connects the left lobe with the diaphragm, and with the œſophagus and ſpleen.

FORM AND DIVISIONS OF THE LIVER.

The liver is convex and ſmooth on the upper ſurface; concave and more irregular on the lower part; thick and maſſy behind and towards the right ſide; but anteriorly and toward the left ſide it is thin, and has an acute edge, ſo that it lies ſmooth over the diſtended ſtomach.

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* See vol. ii. p. 171. and Plate, p. 173.

GREAT RIGHT AND LEFT LOBES OF THE LIVER.—The firſt great diviſion of the liver is marked on the convex ſurface by the broad ligament; which running back from the foſſa umbilicalis divides it into the two great lobes, the right and left. When the concave ſurface of the liver is turned up, we ſee the ſame diviſion into the right and left lobes by a fiſſure which runs backwards.

It is on this lower ſurface of the liver that we have to mark the greater variety of diviſions in this viſcus. Farther, it is on the right lobe that thoſe eminences are to be obſerved, which, with the indentations and ſulci, give ſome intricacy to this ſubject.

LOBULUS SPIGELII *.—The lobulus ſpigellii is betwixt the two greater lobes, but rather belonging to the right great lobe. From its ſituation deep behind, and from its having a particular papilla-like projection, it is called lobulus poſterior, or papillatus. To the left ſide it has the fiſſure for the lodgment of the ductus venoſus; on the right, the fiſſure for the vena cava; and above, it has the great tranſverſe fiſſure of the liver for the lodgment of the cylinder of the porta: obliquely to the right, and upwards, it has a connection with the lower concave ſurface of the great lobe by the proceſſus caudatus, which Winſlow calls one of the roots of the lobulus ſpigellii. It is received into the boſom of the leſſer curve of the ſtomach.

LOBULUS CAUDATUS †.—This really deſerves the name of proceſſus caudatus, for it is like a proceſs of

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* *Lobulus poſterior—poſticus—papellatus.*

† Proceſſus caudatus.

the liver, ſtretching downward from the middle of the great right lobe to the lobulus ſpigellii. It is behind the gall-bladder, and betwixt the foſſa venæ portarum and the fiſſure for the lodgment of the vena cava.

LOBULUS ANONYMUS * is the anterior point of the great right lobe of the liver: or others define it to be that ſpace of the great lobe betwixt the foſſa for the umbilical vein and the gall-bladder, and extending forward from the foſſa for the lodgment of the porta, to the anterior margin of the liver.

SULCI, AND DEPRESSIONS OF THE LIVER.—On the lower ſurface of the right lobe there may be obſerved two ſlight excavations, formed as it were by the preſſure of the colon and of the kidney. On the lower ſurface of the left lobe there may alſo be obſerved depreſſions anſwering to the convexities of the ſtomach and colon. But theſe are only the ſlighter irregularities which might paſs unnoticed. There are, beſides theſe, deep diviſions which paſs betwixt the lobes and lobuli, and indeed form theſe eminences.

UMBILICAL FISSURE †.—From the anterior point of the two lobes there paſſes backwards to the left ſide of the lobulus ſpigelii a deep fiſſure, which in the fœtus gives lodgment to the umbilical vein, and which in the adult receives the round ligament, where it is about to terminate in the left diviſion of the vena portæ. The back part of this fiſſure gives lodgment to the ductus venoſus in the fœtus. This fiſſure divides the liver into its two right and left diviſions, and upon the right ſide joins the tranſverſe fiſſure.

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* Lobulus acceſſorius—anterior—quadratus.

† Horizontal fiſſure, foſſa longitudinalis, longa anterior.

THE TRANSVERSE FISSURE is that which paſſes above the lobulus ſpigelii, and lobulus quadratus; the proceſſus caudatus, and the lobulus lobi ſiniſtri. It is in this fiſſure that the great tranſverſe diviſion of the vena portæ lies.

THE POSTERIOR FISSURE* gives lodgment to the ductus venoſus. It is a diviſion in the poſterior margin of the liver betwixt the left lobe, and the lobulus ſpigelii, and great lobe on the right. Sometimes, inſtead of the fiſſure or ſulcus, there is a canal, as it were, in the ſubſtance of the liver.

The fourth great fiſſure, is that for the lodgment of the vena cava. It ſometimes is called, in contradiſtinction to the laſt, the right fiſſure, or the FISSURA VENÆ CAVÆ. It is a large deep diviſion betwixt the lobulus ſpigelii and the back part of the right lobe, for receiving the vena cava as it paſſes up upon the ſpine.

The gall-bladder being ſunk in the ſubſtance of the liver, the pit or excavation which receives it has been conſidered improperly as a fiſſure or foſſa†. There likeways occur irregular fiſſures in the ſubſtance of the liver, which are like the cuts of the knife, and hold no regular place.

OF THE VESSELS OF THE LIVER, AND OF THE CIRCULATION OF THE BLOOD THROUGH IT.

There belong to the liver five diſtinct ſyſtems of veſſels: theſe are, the vena portæ; the arteria hepatica;

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[*] Or ſulcus ductus venoſi, the left fiſſure.

[†] It is generally called, *fovea fellis,* or *vallicula veſiculæ felleæ.*

ca; the vena cava hepaticæ; the lymphatics; and the biliary ducts *. Theſe, with the nerves, form a very intricate ſyſtem of veſſels, but a leſſon of the moſt particular importance to the phyſician. Before ſpeaking of the connections which theſe veſſels conſtitute with particular parts, or with the entire ſyſtem, we ſhall take a ſtrictly anatomical view of their origin and courſe.

THE VENA PORTÆ.

This vein is divided into two parts; that which belongs to the inteſtines, and which, ramifying on the meſentry, receives the blood of the meſenteric arteries; and that part which branches in the liver, and diſtributes there the blood which it has received from the arteries of the membranous viſcera. Even from this diviſion we ſee that the vena portæ has a very particular diſtribution; that while it is collecting its branches from the ſpleen, ſtomach, and inteſtines, like the veins in the other parts of the body, into a trunk, this trunk, inſtead of leading directly to the heart, or uniting with other veins in their courſe to the heart, enters the liver, and, like an artery, ſpreads into minute ramifications; hence it is called the vena arterioſa. It reſembles an artery in this alſo, that it has no valves like other veins.

To be more particular; the vena portæ takes its origin from the extreme branches of the cœliac, upper

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* And we might add, the arteries of the outer membrane of the liver which ariſe from the internal mammary, phrenic, epigaſtric, and even the ſpermatic arteries.

and lower meſenteric arteries. The roots of the portæ anſwering to theſe arteries are the ſplenic vein; the gaſtro-epiploic vein which runs upon the great arch of the ſtomach; the meſenteric vein returning from the ſmall inteſtines; and the right and middle colic veins, and internal hæmorrhoidal vein and left colic returning upon the meſocolon. Theſe anſwering to the three great branches of the abdominal aorta, paſs obliquely upward in three great diviſions, and unite with ſome leſſer veins, as the coronary and ſmaller veins of the ſtomach, and pancreatico-duodenalis. The trunk of the vena portæ is now involved in the irregularly reticulated web of the hepatic veſſels, arteries, veins, glands, lymphatics, nerves, and biliary ducts, with their cellular membrane. It paſſes upward ſomewhat obliquely to the right; and enters the PORTA* or the ſinus betwixt the proceſſus caudatus and lobulus ſpigelii.

When the vena portæ has entered the liver, it divides into two great branches, which running directly tranſverſe, and being of large capacity, are ſometimes called the cylinder of the vena portæ. Of theſe two great branches of the vena portæ within the liver, the right is greater in diameter, but ſhorter †: it ramifies in the great right lobe of the liver. The left is longer conſiderably, and filling the tranſverſe fiſſure it is reflected up into the umbilical or horizontal fiſſure, and is given to the left lobe, to the upper and more anterior part of the right lobe, viz. lobulus anonymus, and to the lobulus ſpigelii.

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* Sometimes it has been found divided before entering the liver. It has been alſo found to divide into three branches, in which caſes, ſays Haller, two go to the left ſide.

† Into this branch ſometimes the vein of the gall-bladder enters.

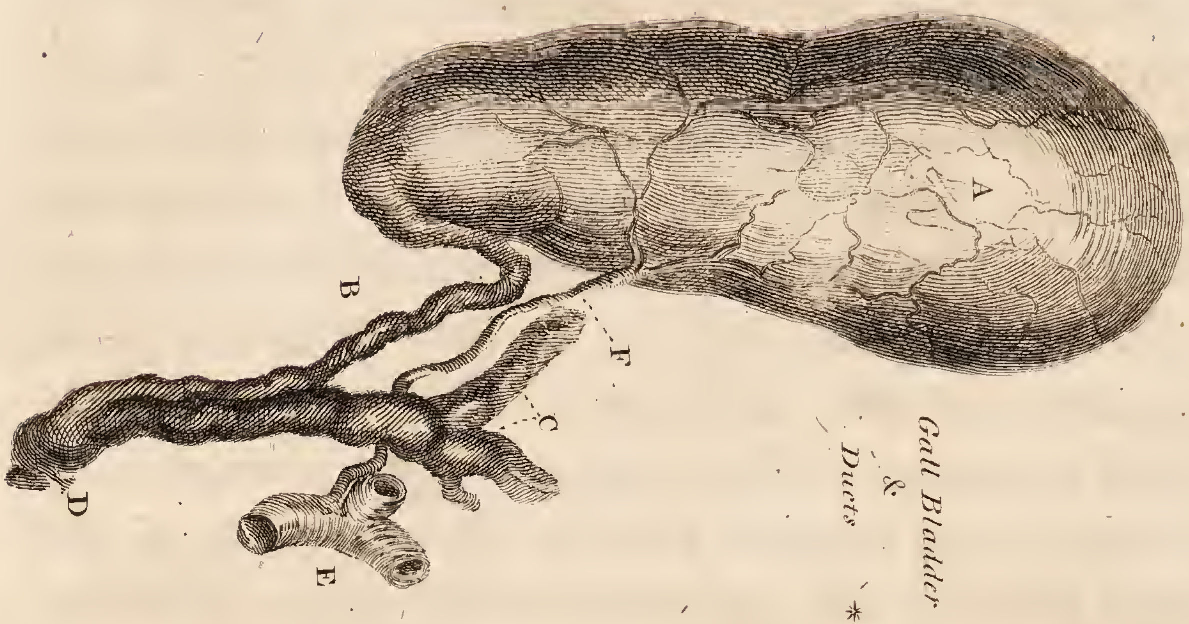
The minute ramifications of the vena portæ every where pervade the ſubſtance of the liver, and inoſculate with the veins of the ſurface belonging to the peritoneal coat. The blood of the vena portæ, after ſecreting the bile, is received into the extremities of the venæ cavæ hepaticæ.

ARTERIA HEPATICA.

For the courſe of this artery from the root of the cœliac artery, to its entrance into the liver, ſee vol. ii. p. 416. and 419. The arteria hepatica and the venæ portæ are ſupported by the ſame ſheath, the leſſer veſſel encircling the greater, like a tendril. While they have diſtinct functions, both terminate in the ſame returning veins: that is to ſay, whether we admit that one or both open into the biliary ducts, yet they have the ſame relation to the venæ cavæ hepaticæ which the arteries of the other parts of the body have to their returning veins.

VENÆ CAVÆ HEPATICÆ.

We have ſeen, that the right auricle of the heart is cloſe to the diaphragm above, and that the liver adheres to the lower ſurface of the diaphragm. We have alſo found that there was a groove in the back part of the liver for the tranſmiſſion of the venæ cavæ abdominalis. Now as the venæ cavæ aſcending from the lower parts of the body to the heart is perforating the diaphragm, it is joined by two large veins from the liver, which, from their ſize and form, being the returning veins of the liver, are termed in general the venæ cavæ hepaticæ. Theſe veins ſometimes pierce the diaphragm alongſt with the cavæ abdominalis, ſo that there is to be obſerved one large perforation in the diaphragm, but generally they paſs the diaphragm cloſe to the great vein, but ſo that there are three openings in the diaphragm. When theſe hepatic veins are traced into the ſubſtance of the liver, they are ſeen to be gathered together from all parts of the liver in two, or ſometimes three great branches. The communication betwixt the vena portæ and the venæ cavæ hepaticæ are ſo free, that ſeveral anatomiſts have imagined a peculiar and more immediate communication of their branches than holds in other parts of the body betwixt the arteries and veins; a circumſtance which appeared to them the more neceſſary, conſidering the leſſer impetus with which the blood flows in the vena portæ than in the arterial ſyſtem.



BILIARY DUCTS *.

The laſt ſubdiviſion of the ſubſtance of the liver, or acini, as we ſhall preſently find, is ſupplied with a branch of the venæ portæ, arteria hepatica, and venæ hepaticæ. With theſe there is alſo ſeen a minute ramification of the excretory duct of the liver. Theſe laſt minute branches are the roots of the biliary duct; which running into each other form trunks reſembling the branches of veins, and which attaching themſelves to the vena portæ form the greater trunks, anſwering

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* *Explanation of the plate of the gall-bladder.*

A	The gall-bladder.
B	The cyſtic duct.
C	The hepatic duct.
D	The common duct.
E	The hepatic artery.
F	The cyſtic artery coming off from it.

to the right and left ſide of the liver. Theſe two diviſions of the hepatic duct approaching each other, unite (C), while they are attached to the right branch of the vena portæ. Their union conſtitutes the hepatic duct, or ductus choledochus.

When the duct of the liver has advanced a little way from the tranſverſe fiſſure, it is joined by the CYSTIC DUCT (B), or perhaps we ſhould rather ſay, conſidering the uſe of the cyſtic duct, that it is reflected from it at an acute angle to the right ſide. The DUCTUS CYSTICUS is much ſmaller than the hepatic duct; and is ſomewhat curved in the direction towards its expanſion into the gall-bladder; for there it takes a very ſudden turn downward, as is ſeen in the marginal plate.

The hepatic duct, after being joined by the cyſtic duct, continues its courſe under the name of ductus communis choledochus, or common duct *. Now become ſomewhat larger, it takes its courſe under the head of the pancreas to the back part of the duodenum, about five inches from the pylorus.

Before it enters the gut, or more generally while included in the coats, it is joined by the pancreatic duct. Having pierced the muſcular coat, it runs for ſome time in the cellular coat, in the length of the gut, and then opens upon the eminence of a conſiderable valvular plica of the inner coat.

This hole is regularly limited, and by no means equal to the diameter of the duct, either where it is contained within the coats of the gut, or in its courſe

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* Ductus choledochus, hepatico cyſticus, (D.)

from the liver to the gut. Sometimes the hepatic and pancreatic duct open by diſtinct perforations.

The outer coat of theſe ducts is ſmooth and ſtrong *; within this a cellular and nervous coat is deſcribed †, and muſcular fibres imagined; but the inner coat is worthy of attention. It is reticulated in ſuch a way, that a probe puſhed up the duct is catched by their valve-like action ‡.

GALL-BLADDER.

We have already noticed, that the gall-bladder is attached to the lower ſurface of the right lobe of the liver, and partly buried in its ſinus: it has ſometimes occurred that it was merely ſuſpended to the liver by a membrane like a meſentry. It is a bag of a pyriform ſhape; its greater end or fundus is contiguous to the colon; its lower end or neck to the duodenum. It has been found wanting altogether §. It is generally of a ſize to contain an ounce, or an ounce and a half of bile.

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* Although this coat reſiſts, in a conſiderable degree, the diſtention of the duct, when blown into or injected, yet the whole are ſometimes ſo diſtended as to admit the thumb. But this is rather to be conſidered as growth and enlargement, than diſtention.

† By Haller.

‡ Theſe I have ſeen miſtaken for actual obſtructions.

§ In which caſe the dilated ducts in their courſe would ſeem to have been capable of retaining a quantity of bile ready to be evacuated into the inteſtine. A double gall bladder has ſometimes been found.

The coats of the gall-bladder are the outer peritoneal coat *; a middle cellular coat, what from its analogy to that of the inteſtines we ſhould call vaſcular coat; and an inner coat. In the intermediate coat muſcular fibres have been looked for with great eagerneſs, but none have been demonſtrated, although a conviction remains that there are muſcular fibres in the compoſition of the coats of the gall-bladder. This coat gives form, limit, and ſtrength to the gall-bladder. The third or inner coat is formed into innumerable rugæ, ſo as to take a cellular or reticulated texture. Theſe loculi, as we may call them, thus formed by the duplicature of the internal membrane, are of conſiderable variety of ſhape, ſquare, round, or triangular. Theſe rugæ, and the whole internal membrane of the gall-bladder, have a beautiful and minute net-work of veſſels upon them; and in theſe cells there can be little doubt that there are ſmall mucous folicules, or pores, or an exudation from extreme veſſels, whoſe diſcharge ſheaths the ſurface from the irritation of the acrid bile. The extreme degree of vaſcularity and reticulated texture of this inner coat of the gall-bladder is not apparent before the ſixth or ſeventh month of the fœtus, and then it takes a peculiar texture in preparation for the reception of the ſecreted bile.

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* Like the peritoneal coat of the liver, it ſeems to poſſeſs very diſtinct veſſels from the vaſcular coat below. "Si itaque ea, a "reliquis membranis ſolvitur expletis antea materia quadam "colorata vaſis, ab arteria hepatica et vena portarum venienti"bus; videmus *eam* ne minimum quidem accipere ſurculum quo "ornantur *nervea* et *vaſculoſa*." Annotationes Acad. F. Aug. Walter, p. 57.

Towards the opening of the bladder into the cyſtic duct the rugæ take a ſemilunar figure, and ſeem to have a valvular action, in at leaſt ſo far that they ſeem intended to give a degree of difficulty to the paſſage of the bile. The ſame ſtructure of the internal coat prevails in the cyſtic duct.

However ſtrange it may appear to one, conſidering the relation of the liver as a gland to its ducts, and to the gall-bladder as a receptacle of the bile, an opinion was entertained that the bile of the gall-bladder was ſecreted by its own coats, and that it was of a different nature from the bile conveyed from the ſubſtance of the liver. Without further argument it is ſufficient to ſay, that when the cyſtic duct is tied, or when it is preternaturally obſtructed, there is no bile ſecreted into the gall-bladder *.

From the connections of the gall-bladder, and from the conſideration of the whole anatomy, there can remain no doubt that the gall-bladder is a mere receptacle, reſerving a ſufficient ſtore of this fluid for the due change to be performed upon the food: that as the ſtomach is not at all times loaded with food, nor the chyme and fluid from the ſtomach inceſſantly paſſing through the duodenum, neither is the bile at all times running from the gall-ducts. On the contrary, as the ſtomach is emptied of its contents at

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* Were there no other proof of the gall-bladder being merely a receptacle, and not in any degree for ſecreting the bile, the courſe of its veins (which run into the vena portæ) would be ſufficient indication. If they had returned the blood from having performed the ſecretion of the bile, they would have dropt into the cava, and not into the portæ.

ſtated intervals, there ſeems to be a proviſion for a quantity of bile being evacuated from the receptacle and ducts proportioned to the food, and while it is paſſing the duodenum. Whether we ſhould conceive that this is a neceſſary conſequence of the retention of the bile in the gall-bladder, or a wiſe proviſion of nature, I am uncertain; but it appears, that the longer the bile is retained, or the longer the faſt and the deficiency of food in the duodenum, the more acrid and inſpiſſated is the bile, and the greater alſo in quantity. This inſpiſſation of the bile takes place in conſequence of the activity of the lymphatics, which ramifying on the coats abſorb the thinner part of the bile.

Further; I cannot look upon the rugæ and cellular ſtructure of the inner coat of the gall-bladder in any other light than as the means of increaſing the ſurface, and expoſing the bile to a further abſorption of its watery parts than otherwiſe would take place.

The gall-bladder is ſuppoſed by ſome to be emptied by the general preſſure of the abdomen; an opinion founded on a miſtake, which a very little conſideration might correct. Others think that the ſtomach, or duodenum, or colon, being diſtended by the food, compreſs and empty the gall-bladder; while others with more apparent correctneſs allege, that it is emptied in conſequence of a conſent of parts. With the latter I would confidently affirm, that as the aliment paſſes the duodenum, the bile follows apace, either from the alternate contraction and relaxation of the duodenum occaſioning a relaxation of the orifice of the ducts, or more probably from the ducts being excited, as the ſalivary glands are excited by the preſence of ſapid bodies in the mouth. By want and hunger, on the contrary, the gall-bladder is allowed to diſtend: there is no call for its evacuation.

Experiments would even teach us, that the gall-bladder has not the ſame irritability excitable by ſtimuli applied to the coats, as the ſtomach, inteſtines, or bladder of urine; which is a proof that, like the iris, and many other parts of the body, its action is rouſed more powerfully by the ſtimulus of ſympathy and conſent of remote parts, than by the diſtention of its coats; whereas the inteſtines and bladder have it in their conſtitution to be excited to contraction by ſimple diſtention.

From experiments it would appear, in confirmation of what is here alleged, that while the food is in the ſtomach little bile is diſcharged; but that it flows when the matter is paſſing the duodenum, ſo that a great quantity is then formed in the gut. On the contrary, in a ſtate of want and hunger, the gall-bladder is greatly diſtended, and yet little bile flows from it; although it is not only more accumulated, but more acrid and bitter *.

The gall-bladder is not deſtitute, however, of irritability and the power of contraction; for it would appear from many caſes that, like the urinary bladder, it contracts upon concretions, and becomes thick in its coats.

The retention of the bile, ſurcharging the ducts, and diſtending the gall-bladder, and the ſudden diſcharge of accumulated bile, and the irregularities of

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* Anat. generale de Xav Bichattom. iv. p. 615.

its courſe when influenced by diſorder of the viſcera, are the ſource of the moſt ſevere and diſtreſſing ſymptoms *.

In the dead body we ſee the colon and duodenum, or whatever parts lie in contact with the gall-bladder, ſtained with bile; but this evidence of tranſudation which is found in the dead body, is not ſeen in the living; while the ſtain from the bile is obſerved to be deeper and more extenſive in bodies long dead. It is therefore another example of the peculiar properties inherent in the living fibres, that no tranſudation is allowed; but that the fluids, which appear as if exuding from the living ſurfaces, are diſcharges from organic pores, or from the extremities of veſſels.

OF THE MINUTE STRUCTURE OF THE LIVER.

The liver is firmer and dryer in ſome degree than any of the other viſcera; the intertexture of membrane is weak, and in conſequence the ſubſtance of the liver is friable and eaſily torn. When cut or torn, it ſeems for the greater part vaſcular; or it diſplays the mouths of innumerable ducts and veſſels, and, after a minute injection, the blood-veſſels ſeem to pervade every particle, even when examined with the microſcope.

This texture of veſſels, in which we may ſay the ſubſtance of the liver chiefly conſiſts, is ſurrounded

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* We have one example of this in a late Treatiſe on the Diſeaſes of the Bowels of Children, by Dr. Cheyne: an eſſay moſt particularly uſeful in its object; and the reaſoning of which is founded on anatomical obſervation, ſupported by facts, and deductions from practice.

with a delicate membrane, the continued peritoneum. It retains the character of peritoneum, in being a ſimple membrane, whitiſh, and a little pellucid. In this membrane minute arteries and veins ramify, which are unconnected with the internal ſyſtem of veſſels, and in the cloſe cellular membrane beneath it the lymphatic veſſels take their courſe.

When a ſection is made of the liver, the veſſels may be thus diſtinguiſhed: the ducts by the thickneſs of their coats, and their yellow colour; the arteries by a leſs degree of thickneſs, and a more reſiſting elaſticity; the branches of the vena portæ and the cava hepaticæ by the thinneſs of their coats, of which thoſe of the latter are conſiderably the weaker.

With the inveſtiture of the peritoneal coat of the liver even the vaſcular tiſſue of the body of the liver has no communication by veſſels *. It is therefore conſidered as an organ of a peculiarly diſtinct organization. By the proofs from anatomical injections we are informed, that there is a free intercourſe through the extreme branches of all the five ſyſtems of veſſels in the liver. From minute injections, and the trying and making of ſections in the liver, there ſeems no likelihood of gaining information of the ſtructure and connections of theſe veſſels. Walther, who ſeems to have examined more methodically and minutely than any other anatomiſt in any age, could make no diſtinction of parts. In whatever way he made his ſections, whatever ſyſtem of veſſels he filled, whether the whole veſſels or each ſeparately, he could not aſcertain the direction and

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* Soemmering. Walther, loc. cit. &c.

courſe of any particular veſſel, nor its inoſculations, but all was obſcure, and as if conſtituting one chaotic maſs. In wet preparations, however, he obſerved, that the extremities of the branches of the hepatic artery opened into the vena portæ: that the branches of the vena portæ had a double termination: that ſome of them, by a ſudden turn and ſerpentine courſe, terminated in the branches of the venæ cavæ hepaticæ [*]; while others were ſeen to terminate or open into the biliary ducts. Further he obſerved, that in all the branches of the vena portæ there was a peculiar compreſſed appearance which diſtinguiſhed them from all the other veſſels of the viſcus.

There have been obſerved, by almoſt every author, interſections of the intimate membrane of the liver, which divides and ſubdivides the faſciculi of veſſels. Theſe are, however, obſcure diviſions. The laſt perceptible diviſions have been called ACINI [†]; and they are rather preſumed than directly proved to have in their compoſition an extreme ramification of the ſeveral veſſels of which the liver conſiſts [‡].

We have ſeen Malpighi conceiving that theſe bodies were ſimple glands collected on the ramifications of the veſſels; that they were little veſicles; and that from them the pori bilarii took their origin. In this opinion he was ſucceſsfully oppoſed by Ruyſch, who affirmed that theſe were vaſcular; and in this he has been ſupported by Albinus. It would in truth appear, that the deſcription of theſe partitions of the ſubſtance of the liver, and the ultimate ſubdiviſion of it unto theſe little grains, about which there has been ſo much ſpeculation, is not founded in an accurate obſervation, and that there are neither criptæ, hollow or cellular, nor little bodies made up of convoluted arteries, but the minute parcels of veſſels which are obſervable may be called acini, in the ſtrict definition which has been given in the introduction.

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[*] I ſhould imagine that in this he might have been deceived by the leſſer branches of the portæ (filled with injection) opening into the ſide of the larger trunks; and that there is no ſuch termination of the hepatic arteries in the ſides of the vena portarum, ſo that their open mouths are diſcernable.

[†] See the definition in the introduction to the preſent volume.

[‡] Acinos nemo rejicit, ne Ruyſchius quidem, ſed de interiori fabrica diſputatur. Haller.

Finally, Ruyſch's opinion may be given in theſe words: (Epiſt. ad Virum Clar. Ner. Boerhaave, p. 69.) "Sed nolo diutius tergiverſari, fateor ergo, quod, quando primo incipiebam me exercere in anatomicis, videbam tunc quidem, quod in jecore humano ſe oſtendebant acinuli parvi innumerabili numero, quæ tum temporis appellabantur glandulæ; nam nemo cogitabat aliter ſed manet ſola jam hæc queſtio, an acinuli hi hic herentes ſint glandulæ ſimpliciſſimæ, foliculi cavi cum emiſſario an quid aliquid? dico nemo demonſtravit illos tales eſſe ut hic aſſumis. Imo vero facile jam erit demonſtrare, acinos hos cum criptis antea pertractis nihil commune habere: quia oculis noſtris non apparent ut membranulæ cavæ & quia etiam non habent emiſſarium. Sed componuntur tantum ex extremitatibus ultimis vaſculorum ſanguiferorum unitis in formam ſpheræ rotunditatis, neque, quantum poſſum videre etiam membranula aliqua ſua ſingulari circumambiuntur."

OF THE SECRETION OF THE BILE.

Upon reviewing the whole ſyſtem of the liver the peculiarities in the vena portæ ſtrike us the moſt. It occurs to us that the paſſing of this profuſion of blood retrograde into the liver, with the ſlow motion peculiar to venous blood, and after having gone the circulation through the inteſtines, and conſequently loſt thoſe properties which conſtituted it arterial blood, is a proviſion for the ſecretion of the bile. It is almoſt univerſally concluded, that the ſecretion of bile is made from the blood of the vena portæ.

But as we ſee that this blood diſtributed by the branches of the vena portæ in the liver muſt be ſo far exhauſted as to become incapable of all the uſes accompliſhed by the arterial blood in other glands, that although the vena portæ be peculiarly adapted to ſecrete the bile, it is not capable of ſupplying the nutrition and the energy to the ſubſtance and veſſels of the liver, there is a neceſſity for arterial blood being ſent to this gland through a branch of the arterial ſyſtem. We have had occaſion to remark, that no part retains its function in vigour, nor the living properties which are inherent in it, while the whole œconomy is entire and correct, unleſs the blood be circulated through it. Therefore it would appear neceſſary that the arteria hepatica, a branch of the aortic ſyſtem, ſhould alſo be beſtowed upon this viſcus. Theſe arteries perform the ſame office here in the liver that the bronchial arteries do in the lungs, or the coronary arteries in the heart, or the vaſa vaſorum in the great veſſels. The pulmonic artery carries venous blood into the lungs, which having returned from the circulation of the body cannot ſend off ſmaller branches to ſupply the membranes and veſſels of the lungs, it is neceſſary that for this purpoſe branches of the aortic ſyſtem ſhall enter the lungs. Again, in the heart the blood contained in its ventricles is incapable of ſupplying its ſubſtance, or the blood coming through the calibre of the great veſſels cannot be the means of miniſtering to their active powers, but for this purpoſe the vaſa vaſorum are diſtributed through the coats of the veſſels. Theſe veſſels therefore bear an analogy to the arteria hepatica in the liver.

We muſt not however ſuppoſe that this ſcheme of the action of the vaſcular ſyſtem of the liver, however rational and ſimple, will be univerſally allowed. Indeed there are circumſtances which ſeem to ſtand in oppoſition to it. Of theſe, the moſt intereſting is the caſe of unuſual diſtribution of the veſſels of the liver communicated by Mr. Abernethy of St. Bartholomew's hoſpital.

The ſubject was a female infant which was ſuppoſed to be about ten months old. Among other varieties it was obſerved, that the branch of the cœliac artery diſtributed to the liver was larger than common, and exceeded by more than one third the uſual ſize of the ſplenic artery. This was the only veſſel which ſupplied the liver with blood for the purpoſe of either nutrition or ſecretion. The vena portarum was formed in the uſual manner, but terminated in the inferior cava nearly on a line with the renal veins. The liver was of the uſual ſize, but had not the uſual inclination to the right ſide of the body: it was ſituated in the middle of the upper part of the abdomen, and nearly an equal portion of the gland extended into either hypochondrium. The gall-bladder lay collapſed in its uſual ſituation. It was of a natural ſtructure, but rather ſmaller than common. On opening it there was found in it about half a tea ſpoonful of bile. The bile in colour reſembled that of children, being of a deep yellow brown, and taſted like bile, but it was not ſo acridly bitter and nauſeating as common bile.

Mr. Abernethy remarks upon this caſe, that when an anatomiſt contemplates the performance of biliary ſecretion by a vein, a circumſtance ſo contrary to the general œconomy of the body, he naturally concludes that bile cannot be prepared unleſs from venal blood; and he alſo infers, that the equal and undiſturbed current of blood in the veins is favourable to the ſecretion; but that the circumſtances of this caſe in which bile was ſecreted by an artery prove the fallacy of this reaſoning *.

We may further obſerve on this caſe, that it does not prove the bile in the natural œconomy to be ſecreted by the arteries and not by the vena portæ; for the artery here was unuſually large, ſo that it performed a function in this inſtance which it does not uſually perform. On the contrary, had the artery been of the uſual ſize, we might then have concluded that the vena portæ was diſtributed to the liver to ſerve ſome

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* See Mr. Abernethy's caſe, of uncommon formation of the liver. Phyſ. Tranſactions.

leſſer uſe in the œconomy of the ſyſtem, and that it did not ſecrete the bile.

The liver, it is ſaid, was of the ordinary ſize. Now as the bulk of the liver is, in its natural ſtate, made up of the dilated veins, it is ſome proof of what I ſhould imagine had taken place here, that by ſome proviſion of the veſſels the arterial blood had been diffuſed, and the celerity of its motion checked previous to its ultimate diſtribution. Nay, it may have opened into the branches of veins anſwering to the extremities of the vena portæ.

In the deficiency of the due acrid and bitter ſtate of the bile, there is in this caſe evidence that the bile formed from the arterial blood is ſtill unfit for the perfect ſecretion. I conceive this to be countenanced by the circulation of the blood in the liver of the fœtus, and by its effects upon the ſecretion. We have ſeen that almoſt the entire gland is ſupplied with arterial blood returning from the umbilical vein; and the natural deduction from this is, that it is the cauſe of the leſs ſtimulating quality of the bile in the fœtus.

I conclude, that this ſingular and intereſting caſe may ſtrengthen the opinion which ſome have entertained that the extreme branches of the hepatic artery pour blood into the extremities of the vena portæ previous to this formation of the bile by theſe veins; but it ſtill leaves us with the general concluſion that the peculiarities in the diſtribution of the vena portæ are a proviſion for the ſecretion of the bile, and that the branch of the aortic ſyſtem, the hepatic artery, is otherwiſe neceſſary to the ſupport of the function of the liver.

Finally, as to the uſe of the liver independently of the ſecretion of the bile, we muſt lay aſide the opinions mentioned by Haller that it ſupports the diaphragm, protrudes it up in expiration, and receives the contraction of it equally in inſpiration, ſo as uniformly to compreſs the other abdominal viſcera; or that it foments and cheriſhes the ſtomach by the heat of its blood. Theſe are at leaſt as bad as the theories of the ancients mentioned in the beginning of this ſection. Haller's failing is the promiſcuous admittance of all facts and every kind of theory, with a timorouſneſs and indeciſion in giving his own opinion.

There is another remark of Haller which deſerves attention. When I reflect, ſays he, that there is no bile required in the fœtus, there being no food received: when again I ſee that the liver is of great ſize in the fœtus, and not ſmall like the lungs, which are deſtined to an operation in the œconomy after birth, I cannot but ſuſpect that it has ſome other uſe in the fœtus than the ſecretion of the bile. If the umbilical vein had opened directly into the cava, he thinks it would have returned with too great an impetus upon the heart, and would by its preponderancy have retarded the return of the blood from the lower extremities. He thinks that the liver is uſeful in breaking and weakening the impulſe of the blood from the umbilical vein; that it is a guard to the right auricle, which would be otherways endangered by the rapid flow of the blood. Now ſurely the liver is much leſs able to ſtand the impulſe of the blood than the heart; and yet there is no proviſion for the breaking of the force of the blood in the liver. Further, there is a direct duct of communication leading to the heart. There is no reaſon to believe that the umbilical vein carries back the blood with greater force than any other returning vein: on the contrary, from its ſize and the length of its courſe it is natural to ſuppoſe the motion of the blood in it to be very ſlow and equable.

We muſt look upon the peculiarities in the circulation of the blood in the liver of the fœtus as a proviſion againſt the ſecretion of ſtimulating bile; for when the child is born and the circulation altered, bile is formed more abundantly, and becomes the ſtimulus to the whole abdominal viſcera, rouſing them to new action. As to the compariſon which Haller has made between the ſtate of the liver and that of the lungs, it is evident that the latter, though ſmall in bulk, are fully formed, and want only inflation to complete their function. On the contrary, in the liver of the fœtus the veſſels are neceſſarily diſtended with blood, to give them the ſize requiſite for this future function; but that blood, either from its qualities or from the eaſy and direct paſſage it has into the heart, does not ſecrete the bile in quantity and quality ſo as to ſtimulate the ducts and inteſtines, as in the adult circulation. If it did, we ſhould not ſee the alimentary canal of the fœtus loaded with matter, and yet not ſtimulated to action, but in a ſtate of inactivity and torpor.

SECTION II.

OF THE PANCREAS.

The Pancreas is a gland the largeſt of thoſe which have been called conglomorated, that is, diſtinctly conſiſting of leſſer parts united. It is of a long form like a dog's tongue, and lies acroſs the ſpine, and behind the ſtomach. Its excretory duct opens into the duodenum.

The pancreas is confined betwixt the two lamina of the meſocolon, and it is united to them by a looſe cellular membrane; it lies before the great meſenteric veſſels: its ſmall extremity touches the ſpleen, and is near the capſuli of the left kidney: but towards the right extremity it increaſes gradually in maſſineſs until its head lodges upon the duodenum. It is like the ſalivary glands in its appearance, conſiſting of lobules ſucceſſively ſmaller and ſmaller; and it alſo reſembles them in the manner in which its duct is formed. The duct * begins towards the left extremity by exceedingly ſmall branches; theſe running together form a middle duct, which taking a ſerpentine courſe towards the great extremity, and increaſed by the acceſſion of the lateral branches in its courſe, becomes nearly of the ſize of a writing quill. Now approaching the duodenum it unites to the biliary duct, and opens along with it into the duodenum. A valve has been deſcribed as in the extremity of the pancreatic duct, but it is

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* Ductus Virſungi.

certainly incapable of the action of a valve, as the bile has been found to have gone retrograde into the trunk of the pancreatic duct. Sometimes there are two pancreatic ducts, but more frequently the part of the gland next the duodenum, and which is called the round head of the pancreas *, has an excretory duct peculiar to itſelf, which either opens into the duodenum ſeparately from the main duct, by piercing the coats of the inteſtines nearer the ſtomach, or ſometimes opens further down.

De Graff, Ruyſch and many others have made experiments to diſcover the nature of the ſecretion from the pancreas. Tubes were introduced into the ducts, and bottles were appended to them in living dogs, ſo as to catch the pancreatic fluid: it was found roupy, inſipid, and like the ſaliva. It has therefore been concluded, from the colour, ſtructure, ducts, and ſecretion of the pancreas having ſo ſtrict a reſemblance to thoſe of the parotid and ſubmaxillary glands, that it is of the nature of the ſalivary glands of the mouth. The general opinion has been, that it is uſeful in ſecreting a fluid which dilutes and moderates the acrimony of the bile. More accurate chemical examination of the pancreatic fluid has not been made, or has not been ſucceſsful in ſhowing any peculiarity in it.

Conſidering the pancreas as a ſalivary gland, how great muſt be the quantity of fluid poured out by it, if, as we are entitled to do, we take the analogy of the

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* This is what Winſlow calls the little pancreas, and is ſometimes ſchirrous ſo as to compreſs the biliary ducts.

parotid ſubmaxillary and ſublingual glands. Theſe ſalivary glands, although they may be ſaid to ſurround all the jaws from the zigomatic proceſs on either ſide, are nothing in maſſineſs and ſize to the pancreas. Again, the pancreas is moſt plentifully ſupplied with blood-veſſels. Beſides leſſer branches of arteries, the pancreatico-duodenalis gives two branches, which take an extenſive courſe through it, and are joined by other meſenteric twigs; and twigs proceed from the veſſels of the ſtomach, and even from the hepatic artery; but more particularly we have to obſerve the large branches beſtowed upon it by the ſplenic artery, where it takes its courſe cloſe upon it.

While the maſticators are working, the parotid gland pours out ſo great a quantity of ſaliva, ſays M. Helvetius, that it is inconceivable, and what I ſhould not believe, had I not ſeen it in a ſoldier of the guards. A cut with a ſabre in the cheek had opened the ſalivary duct: the wound healing on the inſide of the cheek left a fiſtulous diſcharge from the parotid duct. When he eat, there flowed from this hole a great abundance of ſaliva; ſo that during dinner, which is not long in the Hotel Dieu, it moiſtened ſeveral napkins. How much muſt flow from all the ſalivary glands? How much from the pancreas, which is greater than them all collectively?

Like the biliary ſecretion it is probable that the contents of the ſtomach paſſing the duodenum, or the bile flowing from the biliary ducts, form the ſtimulus to the diſcharge of the pancreatic fluid; and as we ſee that the morſel in the mouth will quickly produce an almoſt inſtantaneous ſecretion and diſcharge of ſaliva, ſo we are led to conclude that the flow of pancreatic fluid may be as ſuddenly produced without the neceſſity of a reſervoir, as in the biliary ſyſtem. We naturally conceive that the effect of this fluid is to diminiſh the viſcidity of the bile, and by diluting it to mix it uniformly with the food. There are however few facts to enable us to reaſon on the effects of the pancreatic fluid. If we give full credit to the experiments of Malpighi and Brunner we may conclude, that when the pancreas is taken away, the more acrid bile cauſes vomiting or voracious appetite by its ſtimulus. Schirrus of the pancreas has been found attended with a coſtive and ſlow motion of the inteſtines; which ſeems to contradict the reſult of theſe experiments on animals; but by the ſchirroſity and enlargement of the pancreas the biliary ducts may have been more or leſs compreſſed, and the retarding of the uſual quantity of the biliary ſecretion might produce the ſlowneſs of the bowels *.

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* According to the hypotheſis of Silvius, the uſe of the pancreas was to ſupply an acid ſpirit or juice, and the biliary ſecretion being of the nature of an alkali, theſe two ſtruggling together cauſed the ſeparation of the chyle from the fæces. This good fight did not ſtop here, but theſe enemies being carried into the blood continued their warfare in the heart itſelf, and lighted up the vital flame there.

Nay, if we believe the experiment of F. Schuyl, (de Veteri Med.) this hypotheſis was not without its proofs; for having tied in the portion of the duodenum of a living dog, where the pancreatic and biliary ducts enter, he ſaw the ebulition from this ſtruggle of the acid and the alkali; and when he compreſſed the hepatic duct, the tumifaction of the inteſtine ſubſided; when he took off this compreſſion it was again blown up. As this experiment has not ſucceeded ſince, as Haller obſerves, Schuyl was probably deceived by the periſtaltic motion of the inteſtines.

SECTION III.

OF THE SPLEEN.

THE ſpleen is a viſcus of an irregular, oval figure, and dark purple colour. It is attached to the great extremity of the ſtomach. It is ſoft in its ſubſtance; and has the peritoneal coat very delicate. We ſhould be glad could we ſay that it is of a parenchematous ſtructure, for in truth little is known of its organization.

In treating of this ſubject we muſt be indulged in ſome ſpeculation; and indeed it is privileged ground; for the hiſtory of the opinions regarding the ſuppoſed function of the ſpleen is full of looſe conjectures or wild hypotheſis, and nothing is as yet certainly known of its uſe.

SEAT AND CONNECTIONS.

The ſpleen is ſeated in the left hypochondrium; above the left kidney; and under the protection of the falſe ribs; and of courſe it is under the edge of the diaphragm. It is connected with the ſtomach by the cellular membrane, by the omentum, and in a ſtill more particular manner by the vaſa brevia. It has alſo connections with the left extremity of the pancreas by cellular membrane, and the branches of the ſplenic veſſels. Laſtly, it has a firmer attachment to the diaphragm, by means of a ligament formed by the peritoneum *.

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* Yet the ſpleen is very apt to change its ſituation, or to fall down under the protection of the falſe ribs. It is liable to enlargement

The ſpleen is of no regular figure. Where it is contiguous to the diaphragm it is uniformly convex: towards the ſtomach its ſurface, while it is hollowed out and concave, preſents two ſides, ſo that we ſay the whole maſs is ſomewhat of a triangular form. The anterior edge of the ſpleen is notched with deep ſulci; behind and at the upper part the margin is large and round.

The ſubſtance of the ſpleen is the moſt ſpongy, tender, and ſoft of the abdominal viſcera; ſo much ſo that not only does the finger make an impreſſion upon its ſurface, but it actually diſorders and tears its veſſels. After a ſucceſsful injection the whole ſeems made up of veſſels; and if any thing like acini or globules are to be obſerved, the microſcope will ſhow them to be accidentally produced by the faſciculi of veſſels. It has a ſtrict reſemblance to the ſubſtance of the placenta. The ſpleen is ſeldom ſmaller than natural; often greatly enlarged. I have ſeen it equal to the liver in ſize, and filling the whole left ſide of the belly. It has been frequently found thus enlarged, without any peculiar ſymptoms indicating ſuch a diſeaſe during life. From its ſoft texture and great vaſcularity, like the liver, it has been found rent by blows and falls; and wounds here, as in the liver, by opening the large veſſels are ſuddenly fatal. Sometimes it is hard and ſchirrous, and marbled in its colour. There is ſeldom ſuppuration in it. The ſpleen has been

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largement in aſcites. From which circumſtances it will not be wonderful if it is wounded in tapping for the aſcites. See Monro on Dropſy.

ſuppoſed to ſwell up and enlarge when the ſtomach is empty, and to be contracted when it is full. It has been obſerved, that it is large and ſpongy in thoſe who have died a lingering death, or who have been long ailing: that on the contrary, it is ſmaller and firm in thoſe who have died ſuddenly a violent death.

We are informed, that the blood of the ſplenic vein is peculiar, inſomuch that it does not coagulate like the blood in the other veins of the body*.

That which more than any other circumſtance excites our attention, is the great ſize of the blood veſſels of the ſpleen. Both the ſplenic vein and the artery are of great ſize in proportion to the bulk and weight of the ſpleen; and in their courſe they are particularly tortuous. I conceive we may alſo draw conſequences from the diſtribution of their branches to the ſtomach (viz. the vaſa brevia and left gaſtro epiploic) and to the pancreas. Its lymphatics are numerous. It is ſupplied with nerves, but has very little ſenſibility. It has no excretory duct.

OPINIONS REGARDING THE USE OF THE SPLEEN. Of the various uſes of the ſpleen, the loweſt conjecture in reſpect to ingenuity or probability is, that like a ſand-bath it foments the ſtomach, and promotes the proceſs of digeſtion. This notion is perhaps not inferior in abſurdity to that opinion which aſcribed to the ſpleen the office of forming an acid juice, which being carried by the vaſa brevia into the ſtomach, was ſuppoſed to excite the appetite *.

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* With regard to this point I have no opinion, having hitherto neglected to examine the fact.

It was a better conception that the ſpleen is the ſeat of melancholy; "that moping here doth hypochondria ſit:" or of "laughter holding both his ſides," of which the holding of the ſides was an evidence. And again, ſince tickling the ribs is a demonſtration of the effect from this excitement of the ſpleen †, that the growth of the ſpleen promotes laughter to ſuch a degree, that it becomes a permanent ſilly ſimper impertinently excited. Nay further, we have authority for the exciſion of the ſpleen from thoſe who are otherwiſe incurable in their propenſity to laughter.

The following is a theory which has been very commonly received. A great quantity of blood is imported into the ſpleen with a ſlow motion, owing to its ſerpentine courſe. When the ſtomach is empty, the blood is received in a greater quantity by the ſpleen, where it has an opportunity of ſtagnating. Here the blood fomented, attenuated, and in a manner diſſolved by the

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* I am miſtaken in calling this the loweſt in abſurdity. The ſpleen has been conſidered as the ſeat of the ſoul! the cauſe of venereal appetite! the gland which formed the mucilaginous fluids of the joints! The atrabilis was received here concocted and tranſmitted to the liver. It drew forth and formed blood from the ſtomach, &c. Other phyſiologiſts, not contented with the theories preſented to them, and yet incapable of ſuggeſting others more likely, have very modeſtly aſſerted that the ſpleen was of no uſe at all.

† Riſus in liene ſedes videtur ex effectu titilationis nataque in plurimis mortalibus riſum excitat. &c. Haller. His ſober objection is, that tickling the right ſide will do as well as the left.

neighbourhood of the putrid fœces in the colon, enters upon the firſt ſteps of a begun putrifaction. By this reſolving of the blood it is made more fluid, in which ſtate it is returned by the veins, there being no excretory ducts. Now when the ſpleen is compreſſed between the diſtended ſtomach and the ribs, and the contracting diaphragm, the blood is preſſed out from it in greater quantity and celerity towards the liver, mixing with the ſluggiſh blood in the trunk of the vena portæ, repleniſhed with the fat and oil of the omentum, it dilates it and prevents its ſtagnation and tendency to congeal. In ſhort, the ſpleen has been ſuppoſed to be ſubſervient to the function of the liver, and to the preparation of a watery (and ſubalkaline) fluid to the blood of the portæ. Another opinion has been, that it counterbalanced the maſs of the liver ſeated to the right ſide of the belly.

Hewſon entertained a theory regarding the uſe of the ſpleen which ſullies his high character and reputation. He conceived that the ſpleen added the flat veſſicle of the globules of the blood: his only obſervation in way of proof was, that he ſaw a few red globules returning by the lymphatics of the ſpleen: the effect, I have no doubt, of the injury of its ſubſtance, or of the compreſſion of its veſſels. It ſeems to me ſtrange that ſuch a man ſeeing the large ſplenic artery throwing its full tide of perfect arterial blood into the ſpleen, full of globules, complete in every reſpect, and again ſeeing a few globules carried back by the lymphatics, ſhould imagine that this artery formed theſe few veſſicles with which it was already ſo fully charged.

Of late years we have ſeen men endeavouring to raiſe themſelves into notice by an attachment to the opinions of their departed patrons; by ſupporting thoſe opinions; by holding, as they imagine, the proofs and illuſtrations of them in their poſſeſſion: but ſeldom do we ſee the memory of great men honoured by ſuch obſequies. The officiouſneſs of Hewſon's friends in promulgating his opinions has done no honour to his memory. They have attempted to ſupport, on inſufficient grounds, what he might have had the ingenuity to render plauſible, and which are very far from honourable to his reputation, imperfect as they now appear.

I conceive the ſpleen to be an organ ſubſervient to the ſtomach: and not only the conſtant attachment of it to the ſtomach in the human body, but the conſtancy with which it is found connected with the ſtomach in the lower animals, confirms the opinion. I regard it as a proviſion for giving the veſſels of the ſtomach an occaſional power and greater activity, enabling them to pour out a quantity of fluid proportioned to the neceſſity of the digeſtion. In the firſt place, let us examine the courſe and form of the ſplenic artery, and I think we ſhall find the great peculiarity of its ſize, and tortuous form, and ſtrong coats, a proviſion for occaſional great increaſe of power; while, if not rouſed by the peculiar ſympathies which actuate it, it is of a form to retard and weaken the velocity of the blood. This is founded on theſe propoſitions:

1. The muſcular power of an artery increaſes as it recedes from the heart; the elaſtic power diminiſhes.

2. An artery, the nearer it approaches to its final diſtribution, is the more immediately under the excite-

ment and controul of the organ; is active when the organ is excited; is, relatively ſpeaking, quieſcent when that organ is not called by its ſympathies to exerciſe its function.

3. An artery tortuous in its courſe has more muſcularity and greater power of action than one which takes a ſtreight courſe; but in proportion to the increaſe of power which it obtains by its increaſe of length in this tortuous and bending courſe, will theſe turns retard and weaken the force of the heart upon the extreme ramifications of the veſſel.

Thus a tortuous artery is the means of increaſing the velocity of the blood by its own action, but it makes the organ leſs dependent on the general force of the circulation. We accordingly find that in thoſe organs where there is occaſional activity alternating with a quieſcent ſtate, the artery is tortuous; and where there is an increaſe of force required in the circulation, there, the artery, from being ſtreight in its courſe, becomes crooked and twiſted in every way *.

From theſe remarks, we may be inclined to draw, from the tortuous figure of the ſplenic artery, a concluſion ſomewhat different from that which has hitherto

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* This has been ſuppoſed the effect of the impulſe of the blood, but nothing can be more falſe. Let any one examine the artery of a limb when a great tumour is growing; the artery will be found tortuous to ſupply it. Again, in the aneuriſmal varix where there is a breach in the artery, and the blood finds a freer return to the heart, the artery will be found enlarged and tortuous in order to ſupply the lower part of the limb; while there is a quantity of the blood withdrawn from the circulation by the communication with the vein.

been deduced. We may conclude that it is not the means of retarding the blood in its circulation, but of giving force to it. The ſplenic artery does not only ramify in the ſpleen, but it ſupplies all the left part of the ſtomach, and that great ſacculated extremity in particular which receives the food, and in which the proceſs of digeſtion is chiefly performed. My idea is, that when the ſtomach is empty, when there is no food in it to ſolicit the diſcharge of the gaſtric fluid, the blood circulates in a moderate degree in the coats of the ſtomach, and the ſpleen receives the ſurcharge of blood; but when a full meal is taken into the ſtomach, when the action of the gaſtric juice is required in great quantity, the action of the ſplenic artery is ſolicited to the vaſa brevia and left gaſtro-epiploic artery, and thus a ſudden flow of the gaſtric fluid is beſtowed by the increaſed activity of the ſplenic artery. When again the contents of the ſtomach are fully ſaturated with the fluids from its coats, there is no longer an excited action of the ſplenic veſſels, and the artery terminating in the veins, the ſpleen returns the blood to the liver. While the veſſels of the ſtomach partake largely of the ſupply of blood, the arteries to the pancreas alſo receive ſome increaſe of activity; and even the blood of the vena portæ requires an additional activity.

We have ſeen that the ſtomach and inteſtines, the liver, pancreas, and ſpleen are combined in function, connected by the ſame ſyſtem of veſſels, mutually ſubſervient to each other, and tending to the ſame end, the reception, digeſtion, and firſt ſtage of the aſſimilation of nutritious matter to the ſyſtem. We leave this ſubject therefore until we can take up that of abſorption and the lymphatic ſyſtem, and paſs to the kidney and viſcera of the pelvis.

SECTION IV.

OF THE KIDNEY.

THE kidnies are diſtinct from thoſe parts which have hitherto engaged us, as they ſecrete the urine, and form therefore the link betwixt the viſcera of the abdomen and thoſe of the pelvis; for though lying in the abdomen, they are more ſtrictly connected with the parts in the pelvis. The ſtructure of the kidney forms a very intereſting ſubject of inquiry; becauſe it is the field of diſpute betwixt the contending parties regarding the ſtructure of glands and the theory of ſecretion. It is chiefly from the kidnies that the facts are drawn in illuſtration of the opinions of Malpighi, Ruyſch, and all the others.

FORM, SEAT, AND CONNECTIONS. The kidnies lie on each ſide of the ſpine; ſunk as it were in the fat of the loins; attached to the muſcles of the loins; and in part lying on the lower belly of the diaphragm; which laſt connection is the cauſe of the pain felt in reſpiration during inflammation in the kidney. The kidney lies betwixt the ſpine of the ilium and the loweſt rib. The right kidney is placed ſomewhat lower than the left, which is owing to the greater ſize of the liver on that ſide.

The kidnies are without the abdomen, that is to ſay, behind the peritoneum; for the kidney lying cloſe upon the muſcles of the loins, the peritoneum is merely ſtretched over it. This is the reaſon why calculi in the kidney have wrought themſelves out by fiſtulæ in the loins; and it is the ground of the hazardous propoſal of cutting into the kidney to extract calculi.

The adipoſe membrane ſurrounds the kidney, and forms a perfect capſule; for it is this which is ſometimes in an extraordinary degree loaded with accumulated fat. Upon this capſule the cæcum is attached on the right ſide, the colon on the left, and betwixt the kidnies and the inteſtines there is a ſtrict ſympathy, which is apparent in the nephretic colic.

The figure of the kidney is that of an oval bent, or a little incurvated, ſo as to form a ſulcus or general concavity to one ſide, while the other takes a greater convexity. By the concave ſurface of the kidney, which is towards the ſpine and great veſſels, the arteries and veins and ureter paſs in by the ſinus round which the ſubſtance or glandular body of the kidney terminates abruptly.

The abdominal aorta and the vena cava lying cloſe on the ſpine and near to each other, give off laterally the emulgent arteries and veins. The renal or emulgent artery comes from the ſide of the aorta betwixt the upper and the lower meſenteric arteries: that of the left kidney has its origin a little higher than the right: and the aorta being on the left and the cava towards the right ſide of the ſpine, the left emulgent artery is ſhorter than the vein; the artery longer than the vein on the right ſide. Again, the aorta being more cloſely attached to the ſpine, the emulgent vein lies rather above the artery.

The veſſels, and eſpecially the arteries of the kidney, are very irregular in their number and form. Where they enter the body of the gland, they are accompanied with a capſule which continues with them to this final diſtribution. Sometimes a ſolitary veſſel is ſeen making its exit by the convex ſurface of the kidney.

We have had occaſion to remark on the nerves of the kidnies and their connection with the coverings of the teſticle, and to notice their effect in producing numbneſs of the thigh and retraction of the ſcrotum in inflammation of the gland, when ſtones lodge in the pelvis or ureter.

Upon the ſubject of the ſenſibility of the kidney, however, we muſt be aware that diſeaſe, inflammation, ſuppuration, nay even total waſting of the kidney may take place without any indication from pain.

The excretory duct of the kidney is called URETER: it leads from the kidney to the urinary bladder. When we trace it into the kidney it is found to enter the naval-like ſulcus of its concave ſide; here it is enlarged into a conſiderable ſac which is called the PELVIS of the kidney. This is a kind of reſervoir which, lying in the embrace of the ſolid and glandular part of the kidney, ſends up ſeveral elongations almoſt like the finger of a glove, which receive into them the papillæ, the concentrated uriniferous tubes. Theſe proceſſes of the pelvis are called the COLICES or INFUNDIBULI.

It may be obſerved, however, that the term pelvis is taken from the greater dilatation of the ureter within the gland, which is ſeen in brutes; and that in man it is not ſo remarkable, the ureter branching with only a leſſer degree of the ſacculated form into three or four diviſions, and theſe into the leſſer infundibuli.

The coats of the ureter are three in number; a denſe outer coat; a middle coat, apparently conſiſting of circular muſcular fibres, though this has been denied; and a ſmooth inner coat, (very improperly called villous,) which ſecretes a mucus to defend it from the acrimony of the urine. The ureters do not run in a direct courſe to the bladder of urine; they take a curving direction; are in ſome places irregularly dilated, as when they paſs over the pſoas muſcle *, dropping deep into the pelvis, and getting betwixt the rectum and bladder they open obliquely into the latter.

MINUTE STRUCTURE OF THE KIDNEY.

The ancients, ſays Malpighi, contented themſelves with the idea of a ſieve, as conveying a knowledge of the manner in which the urine was drawn off by the kidney; that the fibres of its parenchematous matter attracted the ſerum of the blood; that the fibrous matter was perforated with innumerable foramina; or that the whole was a congeries of canals through which the urine was ſtrained and drawn off. Malpighi ſet himſelf to refute theſe vague opinions by the minute examination of the ſtructure of the kidney; and he ſeems

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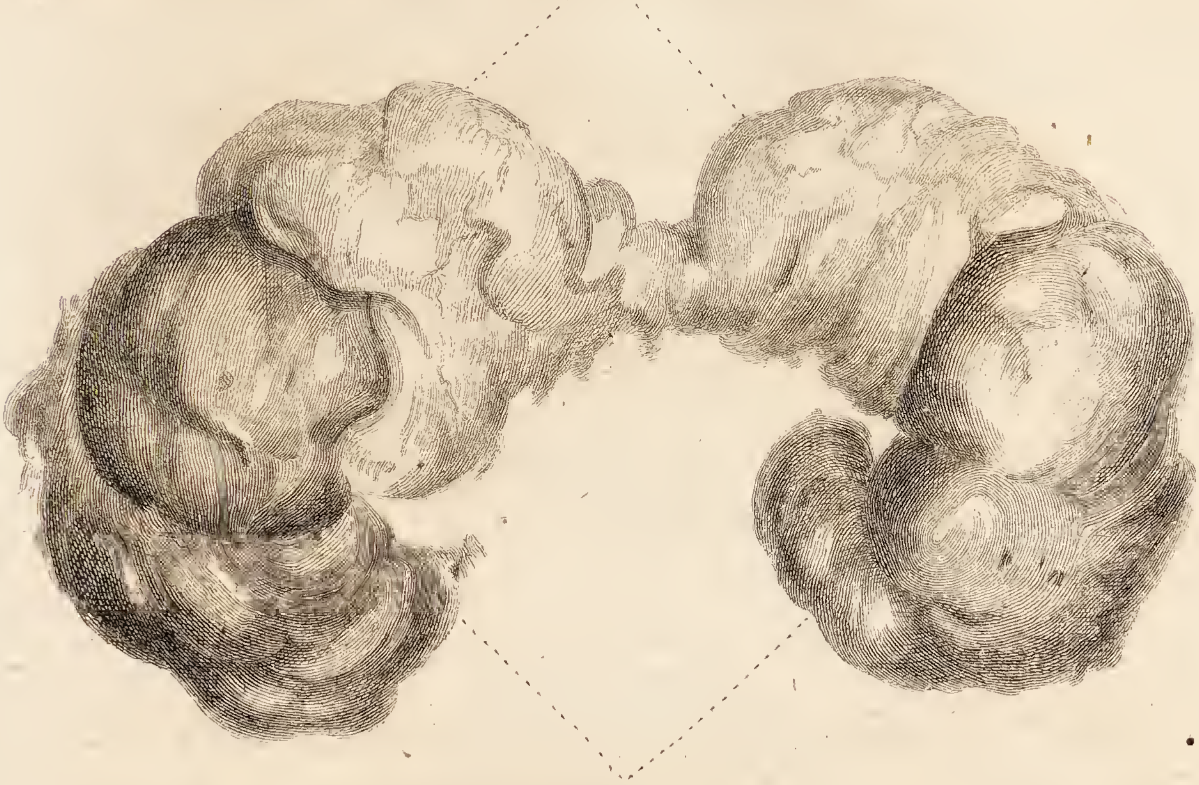
* When the bladder is contracted in conſequence of a ſtone, or when it is dilated by obſtruction, the ureters are dilated alſo; particularly in the firſt caſe. Whilſt they are dilated, their coats become thickened, and their courſe is tortuous.

to have known almoſt all that we now know. Though we do not acquieſce in his opinions regarding the final and minute ſtructure, he deſcribes accurately every part of the gland.



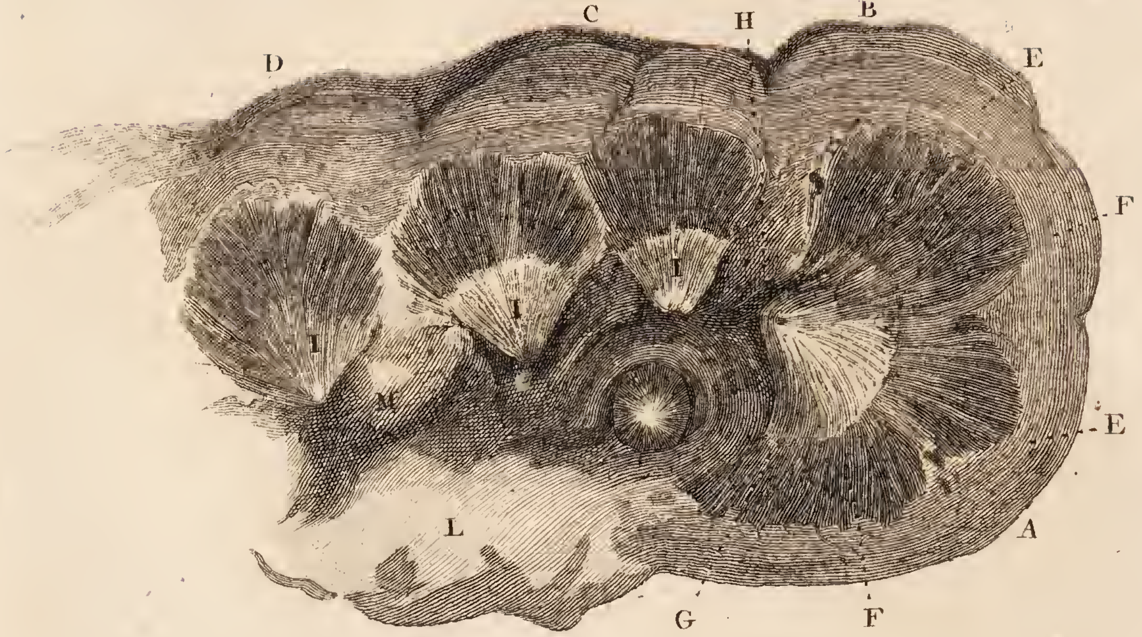
The Lobulated Kidnies of the Foetus.

In the firſt place, when we examine the outward appearance of the kidney of the fœtus, as in this annexed plate, we obſerve that it is not, like that of the adult, ſmooth and uniform ; but that it is tuberculated or lobulated ; that it conſiſts of diſtinct parts, or glands united together. Again, when we examine the kidnies of other animals, we find in ſeveral inſtances that the full-grown animal retains this lobulated form. In ſhort, it immediately ſtrikes us that the kidney is not a uniform maſs of glandular matter, but that it muſt reſemble thoſe glands which they call conglobate, and which conſiſt of ſeveral compartments or diſtinct glands united together.

Accordingly a ſection of a kidney ſhows us that this is the fact.

The

Example of the Lobulated Kidney.



The * ſection of the kidney ſhows us theſe parts. Firſt, we ſee towards the ſurface that which is called the cortical or glandular part E. Secondly, ſtriæ, converging towards the centre of the kidney, being what is called the tubular part of the kidney *. Theſe tubuli are divided into faſciculi, taking a conical ſhape; and theſe converging unite at the apex; two or three of them united form the papillæ. The papillæ are generally ten or twelve in number, or even more, in each kidney; their points are received into the extremity of the infundibula; they pour the urine into theſe tubes, and it is collected in the pelvis. Now when we examine one of theſe papillæ in a lobulated kidney, we find that it is the centre of one of theſe ſubdiviſions. Thus,

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* *Explanation of the annexed plate.*

A B C D. The ſeveral diviſions of the kidney which give it the lobulated figure.

E E. The cortical part of the kidney, being the outer, and, it is ſuppoſed, the ſecreting part.

F F. The tubular part of the kidney.

G. The papilla, or that part which projects into the calyx or diviſion of the pelvis.

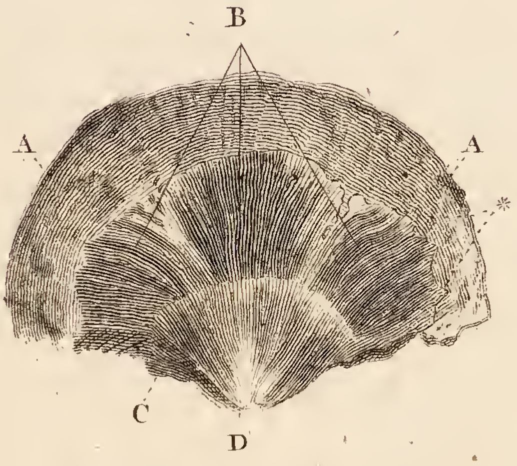
H. The perceptible ducts in the point or apex of the papilla.

I I I. The other papilla.

L. The point of one of the papilla which we ſee projecting into the pelvis.

M. The pelvis of the kidney.

N. B. This repreſents only one half of the kidney.



A A. *Cortical Substance.* B. *Tubular part.*
C. *Papilla.* D. *Ducts.*

The papilla C is merely the continuation of the tubuli B; but it is that part which projects from the body of the kidney into the calyx; and although theſe diviſions of the ſubſtance of the kidney are enumerated as three diſtinct parts, the cortical, tubular, and papillar parts, they are properly only two, the cortical and tubular parts.

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* Improperly medullary, ſometimes STRIATA SULCATA. F F.

Some however have made a new diſtinction, by aſſerting that a vaſcular part is to be obſerved betwixt the cortical and tubular or ſtriated parts, as at *; but it is not the caſe; for although when we make a regular ſection of the whole gland, the mouths of ſome larger veſſels will be obſerved betwixt the faſciculi of the urinary tubes, yet they are irregular ramifications tending to the outer cortical part, and not ſuch as ſeparate the tubular and cortical part, nor ſo regular as to be conſidered as one of the ſubdiviſions of the kidney.

OF THE CORTICAL PART.

The external and cortical part of the kidney is by all allowed to be the ſecreting, or, as they rather term it, the ſecerning part of the organ. It was this part which the older writers conſidered as in a more particular manner to conſiſt of a peculiar fleſhy ſubſtance or parenchymatous matter. It is in this cortical matter that the glandular bodies deſcribed by Malpighi are ſuppoſed to be ſeated. The appearances which he deſcribes are to be very diſtinctly ſeen in many animals; for example, in the horſe's and cow's kidney; and are to be ſeen repreſented in theſe plates. But he aſſerted theſe bodies to be alſo obſervable in the human kidney; to demonſtrate which he ejected a black liquid mixed with ſpirit of wine, by which the kidney becoming univerſally tinged, you may then ſee, he ſaid, when you have torn off the coats of the kidney, ſmall glands partaking of the colour of the arteries. Theſe are the glands of the cortical part of the kidney, which Malpighi deſcribed as hanging upon the branches of the arteries like fruit upon the pendant branches, and round which the arteries and veins ramified and convoluted, like delicate tendrils, ſo as to give them the dark colour which they have.

Into theſe bodies he ſuppoſed the urine to be ſecreted, and from theſe bodies it was conveyed into the uriniferous ducts or tubular part of the kidney; but he acknowledges that the communication betwixt the ducts and glands is very obſcure.

Ruyſch and Vieuſſens held a very oppoſite opinion regarding the ſtructure of the kidney *. Ruyſch, by throwing his injections into the renal arteries, found that he filled the urinary tubes, the ducts of Belini, and the pelvis itſelf. Hence he conjectured that the tubuli uriniferi or excretory ducts of the kidney were the continued branches of the renal artery, without the intervention of any glandular apparatus †.

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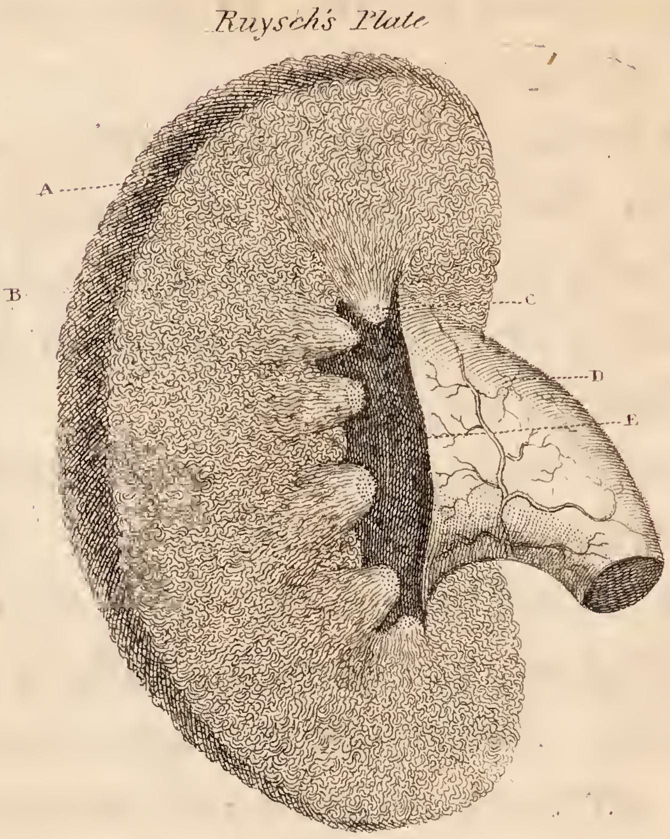
* Ruyſch and Vieuſſens long contended for the claim of the diſcovery of the continuation of the arteries of the kidney into the urinary ducts. Ruyſch at firſt acquieſced in the opinion of Malpighi, as we have ſaid.

† Theſ. Anat. ii. p. 31.

Example of Ruyſch's doctrine *.



Ruyſch did not neglect the examination of the little bodies which are to be ſeen in the cortical ſubſtance. He

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[*] Exhibet renis humani dimidiam partem ita diſſectam, ut reptatus vaſorum, preſertim ſanguineorum, loculentius quam in precedenti Theſauro, tab. iv. fig. iii. videre poſſit; ubi magis inherebam, ut conjunctiones arteriolarum cum ductibus Belini exhiberem, in hac autem figura diſtinctiſſime vaſorum ſanguineorum curſum vermicularem per interiorem renis partem exprimere volui.

A. Facies

He did not however allow they were glands, but confidently aſſerted that they were merely the convoluted arteries which were formed into theſe contorted bundles before finally ſtretching out, and terminating in the ſtraight urinary tubes *.

When after minute injection of the kidney we make a ſection of its whole ſubſtance, we ſee veſſels emerging from the more confuſed intricate vaſcularity of the cortical part, and running inward in ſtriæ towards the papillæ; what we ſee there, are, in my conception, chiefly veins. And this I conclude, both from the reſult of in-

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A. Facies renis exterior per quam vaſa ſanguinea reptatum obſervant vermicularem.

B. Facies renis interior ubi vaſa ſanguinea non minus curſum vermicularem obſervant quam in facie exteriore.

C. Papillæ renales.

D. Pelvis renis.

E. Cavitas pelvis in quam papillæ urinam ſtillando exprimunt.——See Theſaur. Anat. W. p. 27.

* In hoc Theſauro X. quoque inveniuntur objecta renalia ex homine deſumpta, in quibus non ſolum luculenter apparet quid judicandum ſit de prætenſis glandulis renalibus, verum etiam quid inveſtigatoribus renum impoſuerit, ſe in renibus indagandis ſæpiſſime occurrunt corpoſcula rotunda glandulas mentientia quæ revera nil ſunt niſi arteriolarum ultimæ extremitates contortæ; cum autem exactiſſime repleantur arteriæ renales diſſolventur vel expanduntur, quemadmodum fili glomer, ita ut nil minus ſint, ſicuti dixi, quam partes per ſe ſubſiſtentes, & peculiari membranula obductæ ſine quo immerito dicuntur glandulæ. Interim conſiderandum ejuſmodi contorſiones vaſorum ſang. nuſquam in cæteris viſceribus reperiri. In the epiſt. to Boerhaave, p. 77, we find Ruyſch ſpeaking much more modeſtly: "In rene humano rotunda corpuſcula eſſe, fateor, ſed ſunt tam exilia, ut nihil poſſim definire de illis. Adeoque non licet magis dicere quod ſint glandulæ, quam aliud quid."

jections, and from knowing that the veins are in general numerous ſurrounding the excretory ducts; beſides they retain the blood in them like the veins. Theſe veſſels running in ſtraight lines and converging towards the papillæ are not the tubuli uriniferi, but the blood veſſels accompanying them, the tubes themſelves being tranſparent.

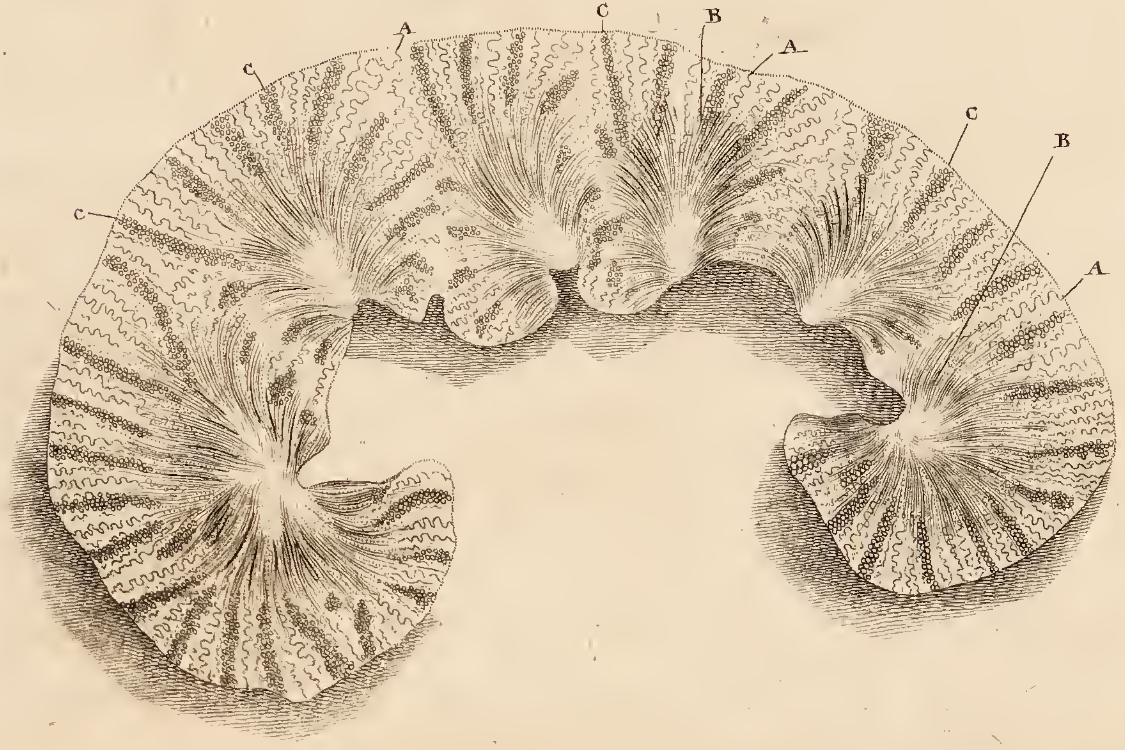
Yet I imagine it was by theſe veſſels that Ruyſch was deceived; for tracing them from the extreme arteries, and ſeeing them ſuddenly altered in their form and direction, and running towards the Papillæ, he imagined them to be the excretory ducts continued from the extreme branches of the arteries.

Winſlow ſuppoſes the corpuſcules, which are ſeen in the cortical part of the kidney, to be the extremities of the cut tubuli, filled either with blood or with a coloured injection. But this they evidently are not; for by making the ſubſtance around them tranſparent, they are ſeen within the ſurface, and they are little grains not the extremity of tubes, nor extended in lines.

Boerhaave, although he ſaw in the preparations of Ruyſch the injection paſſed into the uriniferous tubes, yet in the main favoured the opinions of Malpighi; and having ſometimes obſerved theſe tubes filled with injections, while at intervals they were tranſparent or pale, and contained only a watery fluid, he ventured to conclude that there was a double operation going forward in the kidney; that the pale watery urine was quickly drawn off by the continuous tubes; but that the urine of the other quality and higher colour was ſeparated by a more perfect and ſlower ſecretion through the glandular bodies.

In the hiſtory of opinions, to Boerhaave ſucceeds Bertin, who writes a long and laboured paper in the Memoirs of the Academy of Sciences for 1744; upon the whole, he may be conſidered as endeavouring to prove by diſſection what was rather an hypotheſis with Boerhaave. Bertin deſcribes glands in the ſubſtance of the kidney; but theſe he is careful to diſtinguiſh from the corpuſcles of Malpighi, which he alſo conceives to be the extremities of veſſels merely.

M. Bertin's Plate



From this plate we ſhall eaſily underſtand Bertin's deſcription. He obſerves, in the firſt place, that there are to be ſeen ſerpentine veſſels, ſuch as Ruyſch deſcribed; for example, at A A A*, which ariſing at the

[*] Meſches de M. Winſlow ou veſſeaux ſpongieux de Vieuſſens ou tuyaux ſerpentans de Ruyſch.

circumference of the cortical ſubſtance, are reflected inward in a tortuous form, and which, at laſt, approaching the tubular part, terminate in ſtraight tubes, or are continued into the tubuli uriniferi (for example at B B).

But betwixt the meſches of veſſels which are deſcribed, and which are ſeen here to terminate in the tubuli, there are beds of glands C C C, which acervulæ of ſmall glandular bodies are as it were laid in the tract from the circumference towards the centre, and appear to terminate, or to be connected with the tubuli uriniferi as the arteries are.

M. Ferrein has oppoſed all theſe opinions in a paper of the Academy of Sciences for 1749. He aſſerts that the body of the kidney is neither compoſed of glands nor a congeries of blood veſſels; that it is a peculiar ſubſtance, which when examined is found to conſiſt of tranſparent veſſels. Theſe, he ſays, are wonderfully convoluted in the cortical part of the kidney, ſo as to reſemble glands, and ſtretch in parallel lines towards the papillæ, where they form what is called the tubuli uriniferi. Amongſt theſe tranſparent tubes, the blood veſſels ramify to great minuteneſs, and accompany them where they are reflected directly inward to form the tubuli. Much ridicule, he obſerves, has been thrown upon the term parenchyma of the ancients; but notwithſtanding he affirms that there is in all glands a ſubſtance diſſimilar from the blood veſſels, a gelatinous-like matter, which conſiſts of or contains theſe pellucid tubuli.

Tubular Part.—The term here uſed is univerſally received; and all ſeem agreed that the ſtriæ converging to the centre of the kidney, and taking a pyramidal ſhape are the excretory ducts. We have ſeen that they were ſuppoſed by ſome anatomiſts to be formed by the continuation of the extreme branches of the arteries; but this opinion we ſhall venture to ſay aroſe from the appearance of the blood veſſels injected, which lie parallel and cloſe to them. They are evidently tranſparent tubes, and probably the fibrous appearance of the whole pyramidal body formed by them is owing to the accompanying blood veſſels. Theſe leſſer ducts, as they approach the papillæ, terminate in larger ducts, which finally open into the ducts of Belini at the point of the papillæ. The papillæ we have ſeen to be that part of the pyramidal body which projects into the calyx or infundibulum, and from their point little drops may be perceived to run (from the ducts of Belini) when they are compreſſed.

I have detailed the ſeveral opinions regarding the ſtructure of the kidney; and neither do I wiſh here to vamp up an opinion from the aggregate of theſe contradictory reports, nor have I been able to draw a decided concluſion from my own experience. In truth, the obſervation from one diſſection I have hitherto found ſo completely contradicted by other experiments, that I muſt conclude there yet remains much to be done in inveſtigating the minute ſtructure of the glandular viſcera.

OF THE CAPSULÆ RENALES*.

THE renal capſules are glandular-like bodies one attached to each kidney. The capſule is ſeated like a cap on the upper end of the kidney. It is of a form like an irregular creſcent, and ſuited to the ſhape of that part of the kidney to which it is attached; at the ſame time that it has three acute edges, or takes a triangular form.—(See the drawing of the kidnies of the fœtus.)—The upper edge has been called criſta, while the lower edges have the name of lobes. It is in the fœtus that the renal capſule is large and perfect; in the adult it has ſhrunk, and no longer bears the ſame relative ſize to the kidney. In the fœtus the renal capſule is as large as the kidney, and the capſules of each ſide are continued into each other, being ſtretched acroſs the aorta and vena cava.

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* *Glandulæ atrabilariæ renes ſuccenturiatæ. Glandulæ renales, &c.*

The veſſels ſent to this body are ſomewhat irregular; they come from the renal or emulgent arteries and veins, from the cæliac artery or phrenic, or from the trunk of the aorta, and even from the lumbar arteries.

By ſeparating the lobes of this body we find ſomething like a cavity, which has been roundly aſſerted by ſome to be a regular ventricle; by others altogether denied. Finding a cavity, they ſuppoſed they muſt diſcover the excretory duct. Some conceived that it muſt be connected with the pelvis of the kidney; ſome with the thoracic duct; ſome with the teſticle; but every thing relating to the uſe of this body has hitherto eluded reſearch, and all is doubt and uncertain ſpeculation. For my own part I rather conceive that this body is uſeful in the fœtus, by deriving the blood from the kidney, that gland not having its proper office, of ſecreting the urine, to perform in the fœtus.

PART THE SECOND.

OF THE MALE PARTS OF GENERATION.

OF THE MALE PARTS OF GENERATION.

As there is no very accurate diviſion betwixt the viſcera of the abdomen and thoſe of the pelvis; as the viſcera of the pelvis, when diſtended, riſe into the belly, and are in every reſpect like the abdominal viſcera, many have objected to a diviſion of the viſcera of the abdomen and pelvis: nevertheleſs, there appears to be good reaſon for this diviſion of the ſubject. The function of the parts is different; the manner of their connection is different; their diſeaſes have widely different effects.

We have ſeen that the pelvis conſiſts of the ſacrum and oſſa innominata, and that anatomiſts have diſtinguiſhed the true and the falſe pelvis. The falſe pelvis is formed of the extended wings of the oſſa ilii, and ſupports the viſcera of the abdomen. The true pelvis, marked by the cavity ſinking beneath the promontory of the ſacrum and the linea innominata, contains the rectum; the urinary bladder; the proſtate gland; the veſiculæ ſeminales; and part of the urethra.

The manner in which theſe parts are connected, and the anatomy of the urinary bladder, proſtate gland, and urethra, will form the ſubject of the firſt ſection; while the anatomy of the parts connected with thoſe of the pelvis in function, but ſeated without, will form the ſubject of the ſecond.

CHAP. I.

OF THE PARTS WITHIN THE PELVIS.

We have ſeen that the abdominal viſcera are involved in a common membrane; that this membrane is uniformly ſmooth; and that it has a ſecretion on its ſurface which bedews the whole, and allows the parts an eaſy ſhifting motion on each other. The parts in the pelvis muſt alſo have motion, but they are at the ſame time more ſtrictly connected; a looſe cellular membrane is the medium of adheſion here: the parts are imbedded in cellular membrane, which is interwoven with muſcular fibres towards the lower opening of the pelvis, and further braced by the levator ani muſcle. This gives to the whole due ſupport; enabling them to reſiſt the compreſſion and action of the abdominal muſcles, which they muſt receive in common with the higher viſcera of the belly.

By turning to the firſt plan in this volume we find, that the diviſion of the parts in the pelvis and abdomen is not well defined; but we ſee that the peritoneum is reflected from the pubes over the urinary bladder, and mounts again upon the rectum. The line of diviſion, therefore, is the peritoneum; while we underſtand how the bladder which belongs to the pelvis, being diſtended, carries the peritoneum before it, and riſes into the abdomen.

SECTION I.

OF THE BLADDER OF URINE.

As the general nature of the urinary bladder is ſo well known, nothing is more ſuperfluous than a general definition or deſcription. It is attached behind the os pubis; is nearly of a regular oval, when moderately diſtended, with the ends obtuſe; but from its connections, and the preſſure of the ſurrounding parts, this regular extenſion is not allowed in the living body; it ſtretches more laterally; its forepart is attached broad to the back part of the os pubis; and, behind, it is oppoſed by the rectum. What the name would imply to be the lower part is above; for the *fundus* of the bladder is that part which, when diſtended, riſes into the belly; the neck is where it terminates in the urethra behind the arch of the os pubis. When the bladder is empty, or contains only a moderate quantity of urine, it takes a triangular figure, the baſe of which reſts on the rectum, and the apex is attached to the back of the os pubis; and when in diſſection you look down into the pelvis, you find the back part of the bladder flat, and as it were ſtretched obliquely up upon the os pubis *.

STRUCTURE OF THE BLADDER.—Like the other hollow viſcera, the bladder conſiſts of ſeveral coats.

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* This flatneſs of the bladder, and the nearneſs of the back part of it to the os pubis, the ſurgeon would do well to remember, before he thruſts the gorget or ſtilet with ſuch relentleſs impetuoſity as I have ſeen done.

THE PERITONEAL COAT of the bladder does not ſurround the bladder, but only covers the fundus and back part. It is like in every reſpect to the peritoneal coat of the abdominal viſcera; ſmooth without; and adhering to the inner coat by cellular membrane; which cellular membrane is, however, of a looſer texture, and in greater quantity than in the abdominal viſcera. This peritoneal coat is no doubt of much ſervice as a diviſion in obſtructing the courſe of inflammation ariſing from the diſeaſes in the lower part of the pelvis, or from operations performed on the bladder, rectum, or peroneum; were it not for the looſe peritoneum ſpreading over the cellular texture of the pelvis, we could neither be ſo bold or ſo ſucceſsful in our operations here. That portion of the peritoneum which covers the back part of the bladder, forms a particular tranſverſe fold when the bladder is contracted. This fold ſurrounds the poſterior half of the bladder, and its two extremities are ſtretched towards the ſide of the pelvis, ſo as to form a kind of lateral ligament.

Though in the contracted or moderately diſtended ſtate of the bladder, the peritoneum ſtretches from the back of the os pubis to the bladder, the diſtention of the bladder, in an immoderate degree, raiſes the peritoneum off from the pubes, ſo that the bladder can be ſtruck with a trochar, or lithotomy performed above the pubes, by an inciſion directly into the bladder, without piercing the outer or peritoneal coat.

Towards the lower part, the bladder, as we have ſeen, is inveſted only by cellular membrane, which takes the place of the peritoneal coat of the fundus. While we are aware of the effect of the peritoneum, ſtretched over the parts in the pelvis, in obſtructing the progreſs of inflammation from the bottom of the pelvis towards the abdominal viſcera, we muſt recollect that there exiſts ſuch a ſympathy betwixt the bladder, and the ſtomach and bowels, that both after operation, and in conſequence of obſtruction of urine, the patient will ſink, in conſequence of abdominal inflammation, without the direct ſpreading of the inflammatory action.

MUSCULAR COAT.—The muſcular coat of the bladder is very ſtrong. Three ſtrata of fibres are deſcribed by authors. They are ſo ſtrong as to have been claſſed with the diſtinct muſcles, and the whole coat has been called DETRUSOR URINÆ. Towards the lower part of the bladder the fibres are particularly ſtrong, and formed into faſciculi, and are like a net of muſcles incloſing the bladder.

Towards the neck of the bladder the circular fibres are ſtrengthened; and embrace the beginning of the urethra; and form a ſphincter, which, no doubt, is aſſiſted in its operation by the levator ani muſcle, throwing its ſtrong fibres around the neck of the bladder. The muſcular coat of the bladder becomes greatly ſtronger, where difficulties oppoſe its diſcharge; and when there is a ſource of irritation, within the bladder, acting for any time, the whole coats become thickened, ſometimes to the depth of half an inch or more; in which caſe, as we have obſerved, to take place in the ſtomach, it is capable but of a very inconſiderable change, either by detention or contraction; conſequently the urine runs frequently by painful diſcharges. The lithotomiſt would do well to diſtinguiſh when this ſymptom is merely the conſequence of a ſtone in the bladder, and when it is owing to an increaſe in thickneſs, and a rigidity of the coats of the bladder; for, in the latter caſe, the operation of the gorget is attended with very ſerious evils.

We have an idea of the wonderful degree of contraction in the bladder, and indeed the extent of motion in the muſcular fibre in general, when we conſider that the bladder extends ſo as to contain two pounds of urine, and contracts ſo as to force out the laſt drop from its cavity. When, however, the fibres are ſtretched too far, they loſe the power of contraction, and often the young ſurgeon is deceived by what he conceives to be an incontinence of urine while it is really an obſtruction.

VASCULAR COAT, OR CELLULAR COAT.

When I call this third coat of the bladder the vaſcular coat, it is merely from its analogy to that coat of the inteſtines which I have diſtinguiſhed by the name of vaſcular. Anatomiſts have called it the nervous and cellular coat; the firſt of which is quite improper and the laſt apt to be confounded with the ſurrounding cellular outer coat. This coat (if coat it may be called) conſiſts of very extenſile white lamellæ of cellular membrane. It gives diſtribution to a few veſſels, and connects the muſcular fibres and inner coat.

The Internal coat of the bladder is very ſmooth on its general ſurface, and is bedewed with a ſheathing mucus. When the bladder is diſtended, no inequalities are to be obſerved; but when contracted it falls into folds and rugæ. From an acrid ſtate of the urine;

from ſtrangury, from calculus, the mucous diſcharge is increaſed, even ſo as to form a great proportion of the fluid evacuated from the bladder. No viſible ſource of this mucus is to be obſerved on the inner ſurface of this membrane *; ſo that probably it is a general diſcharge from the ſurface. Indeed, it appears, that no folicules or criptæ, diſcharging at particular points of the ſurface, could have the effect of bedewing and defending the whole ſurface from the acrimony of the urine. The great ſources of the mucus diſcharged with the urine are, the neck of the bladder, the proſtate gland, and the urethra †.

THE URETERS, which convey the urine from the kidnies to the bladder of urine, open very obliquely into the bladder, towards the back and loweſt part of it. The conſequence of their oblique perforation of the coats is, that, the greater the tendency of the urine to paſs retrograde into them from the bladder, (there being a proportioned diſtention of the coats of the bladder,) the more their mouths are compreſſed. Thus, in the dead body, there is no degree of diſtention which cauſes the water to paſs by the ureters. The contraction, or rather the reſiſtance to diſtention, of the ureters and pelvis of the kidnies ſeems much greater than the powers of the bladder are able to oppoſe; for in obſtructions of urine in the urethra,

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* Winſlow, however, deſcribes the glands, and Heiſter and Haller deſcribe folicules, near the neck of the bladder, and round the inſertion of the ureters.

† When the mucous ſecretion is diminiſhed by a diſeaſe of the ſurface, it ſeems much more readily to allow the calculous concretion to form upon it.

there

there is ſtill an inceſſant accumulation in the bladder, even when the bladder has increaſed to ſuch a ſize as to be compreſſed by the action of the abdominal muſcles. The cauſe of this yielding of the bladder to the ſecretion of the kidney is, that it has little permanent contraction, though occaſionally its action is very great.

The URÆCUS does not belong to the human bladder. It is a tube which, in the fœtus of quadrupeds, communicates betwixt the bladder of urine, and the membrane called alantoes. But in the human fœtus there is no ſuch communication; both in the fœtus, and ſomewhat leſs diſtinctly in the adult, there is a ligament like the remains of the duct which runs up between the peritoneum and linea alba of the abdomen towards the umbilicus*.

SECTION II.

OF THE PROSTATE GLAND.

ON the neck of the bladder, and ſurrounding about half an inch of the beginning of the urethra, there is a gland nearly of the ſize and figure of a cheſnut. This body is called the proſtate gland. In all the extent of anatomy, there is not a more important ſubject for the attention of the ſurgeon than this of the ſize, relation and connection, and diſeaſes (with their effects) of the proſtate gland: but to enter upon theſe is not now our object.

The ſhape of this body is round, but at the ſame time ſomewhat pyramidal, for it is broad towards the bladder, and points forward. It has alſo a diviſion, forming it into two lobes; and the older anatomiſts ſpeak of it as double. The urethra paſſes through it; not in the middle, but towards its upper ſurface; ſo that the gland is felt more prominent downward, and is diſtinctly felt by the point of the finger *in ano*. This gland indeed reſts, as it were, on the rectum. By the annexed drawing *, it is meant only to give an accurate conception of theſe parts, and not to repreſent them as they are felt in the living body. For this reaſon the drawing is made from a preparation, and not from the recent diſſection. When the catheter is introduced, and the ſurgeon examines the ſtate of parts by the rectum, he will firſt diſtinguiſh the curve of the ſtaff, covered with the bulb of the urethra: behind this the catheter will feel more bare of parts, but ſtill covered with a greater thickneſs of parts than one ſhould expect from the deſcription of the membraneous part of the urethra. And behind this, again, he will feel the prominence of the proſtate gland, not round, diſtinct and accurately defined, but gradually loſt in both before and behind, among the ſurrounding cellular membrane and muſcular fibres which involve it.

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* It has occurred, that the urine has been in part diſcharged by the umbilicus. This, no doubt, is owing to the ligament remaining permanently as a duct.

The texture of the gland is a compact ſpongy ſubſtance, and when cut has conſiderable reſemblance to a ſchirrous gland. From each lobe there are ſmall folicules opening into the urethra, and from theſe the ducts may be injected.

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* Plates III. and IV.

It has been ſaid, that there is really no diviſion of this gland into lobes: but perhaps the beſt authority on this queſtion is diſeaſe. Now it happens ſometimes that only one ſide of the gland is enlarged, which is a proof that there is ſome diviſion betwixt the lobes. This unequal ſwelling of the gland diſtorts the urethra, and gives it a direction very difficult to be followed by the catheter. In general, when equally ſwelled, the greater part of the gland, being beneath the urethra, raiſes it up ſo that the point of the catheter muſt be raiſed over the enlarged gland before we can paſs it into the bladder. This body is little liable to inflammation, and occaſional tumefaction, ſo as to obſtruct the urine; its enlargement is a chronic ſtate, and peculiar to advanced age.

CHAP. II.

OF THE PARTS CONNECTED WITH THE VISCERA OF THE PELVIS, BUT SEATED WITHOUT IT. —OF THE PENIS AND URETHRA.—OF THE TESTES.

SECTION I.

OF THE PENIS AND URETHRA.

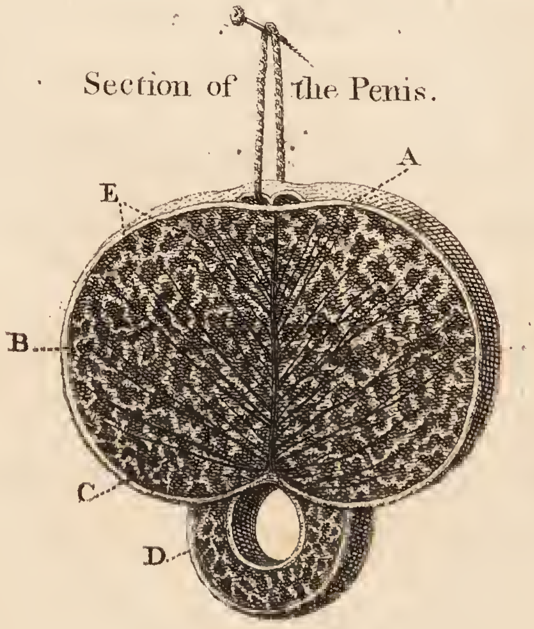
STRUCTURE OF THE PENIS.

THE penis conſiſts of three ſpongy bodies; which, being conſtituted to receive the influx of blood, admit of diſtention, and conſequent erection. Two of theſe bodies are called the CORPORA CAVERNOSA PENIS, and form the body of the penis; the other is the CORPUS SPONGIOSUM URETHRÆ, a veſicular and ſpongy ſubſtance, which ſurrounds the whole length of the urethra, and expands into the bulb of the urethra in the perineum, and into the glans on the point of the penis.

CORPORA CAVERNOSA. The body of the penis conſiſts of two tubes formed of a very ſtrong ſheath. This ſheath has a great degree of elaſticity, but at its utmoſt extenſion powerfully reſiſts the farther diſtention with blood. Theſe tubes are united in the greater part of the length of the penis, or they are parted by an imperfect partition. The root of theſe bodies, or CRURA PENIS, as they are called, ſeparate in the perineum, ſo as to take hold on the ramus of the os pubis. Foreward, theſe bodies or tubes terminate in rounded points under the glans penis.

Theſe tubes are of a ligamentary nature, bating that they have a certain degree of elaſticity. They incloſe and ſupport the cavernous ſtructure of the penis. This ſubſtance conſiſts of cells connected with each other and having a free communication through the whole extent of the penis. Theſe cells are interpoſed betwixt the extremities of the arteries and veins, or probably while the arteries have communication, and open into the extremities of the veins, in the common way, they have ſuch connections with the cellular ſtructure, that in the accelerated action they pour their blood into the cells; yet the blood circulates in the penis during erection as at other times.

Section of the Penis as inflated.



A, Corpus Cavernoſum Penis. B, Septum. C, Urethra. D, Corpus Spong. Minus, or ſpongeoſum Urethræ.

CORPUS SPONGEOSUM URETHRÆ.

Surrounding the urethra there is a ſpongy body ſimilar to that which forms the body of the penis. Where this ſpongy ſheath of the urethra lies in the perineum, betwixt the crura of the penis, it is enlarged with a round head, which is called the bulbous part;—it is upon this, and on about an inch and an half of the lower part of the ſpongy body, that the ejaculator ſeminis, or accelerator urinæ acts; and, as within this enlargement of the ſpongy body which ſurrounds the urethra there is alſo a dilatation of the tube of the urethra itſelf, the uſe of the muſcle is evident. It contracts upon this ſinus of the urethra when diſtended with the diſcharge from the veſiculæ, the proſtate gland, and teſticle. As an accelerator urinæ, it cannot act, but it expels the laſt drop of urine, as a conſequence of their detention in this more dilateable part of the urethra.

The ſpongy ſheath of the urethra, as we have hinted, is enlarged into the GLANS, ſo that the action of the accelerator muſcle affects the whole length of the ſpongy body of the urethra and the glans by the compreſſion of the blood in the bulb.

There is a connection betwixt the glans, ſpongy tube of the urethra, and accelerator muſcle. The excitement of the glans gives the action to the accelerator or ejaculator muſcle; the action of this muſcle compreſſes the bulb, and in conſequence the whole ſpongy body to the extremity of the glans is made tenſe, elongates, and contracts the diameter of the urethra, adapting it to the emiſſion of ſemen. Mr. Home, I obſerve, ſuppoſes "that an action takes "place in the membrane of the urethra during copu"lation, to reduce the ſize of the canal, and fit it for "throwing out the ſemen with the neceſſary velo"city:" but for this, there ſeems no ground nor proof; and I imagine, the action of the accelerator, and the ſtate of diſtention of the ſpongy body, will be a good ſubſtitute to his conjecture.

The obtuſe point of the glans is ſpread upon the extremities of the cavernous bodies of the penis, which yet have no communication with the glans. We obſerve a circular margin, the corona glandis, and behind this the cervix. About the corona and cervix there are many little glandular folicules *, which are no doubt for preſerving the mobility of the preputium.

THE PREPUTIUM is a looſe prolongation of the integuments of the penis, which hangs over and defends the delicate and ſenſible ſurface of the glans. Its inner ſurface is of courſe the continued ſurface of the common integuments, while it again is reflected over the glans. Upon the lower ſide the preputium is tied in a particular manner to the ſurface of the glans behind the orifice of the urethra. This connection limits the motion of the preputium, and is called FRENUM PREPUTII.

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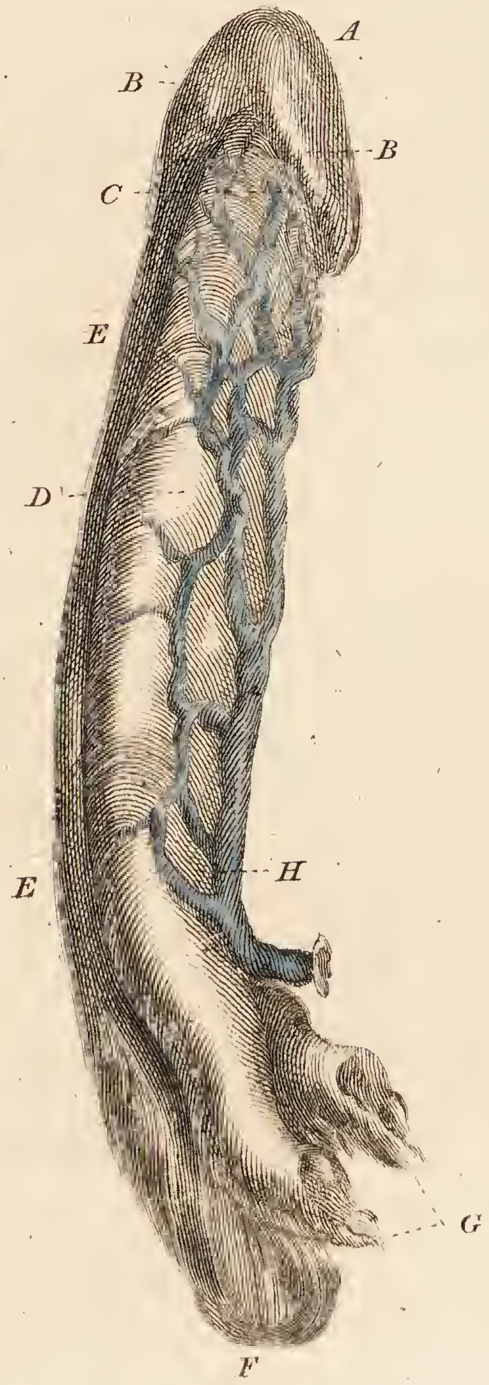
* Glandul. odorif. of Tyſon. See Morgagni.

The whole integuments of the penis are of the ſame cellular ſtructure with thoſe of the reſt of the body, and may be with equal facility inflated: they are particularly looſe and diſtenſible, and unincumbered with fat.

A third common integument of the penis is diſtinguiſhed, and is called the tunica nervoſa. It is of a more firm elaſtic ligamentary ſubſtance. A ligament, however, is not elaſtic, and the firmneſs here is merely that of a greater degree of condenſation in the common membrane. It is this membrane, which being attached to the os pubis, and ſupporting the penis, forms the ligamentum elaſticum ſuſpenſorium.

A Glans.
B B Corona Glandis.
C Cervix.
D Corpus Cavernoſum Penis.
E E Corpus Spongeoſum Urethræ.
F Crura of the Penis, by which it is attached to the Ramus of the Pubis.
H Vena ipſius Penis.



OF THE URETHRA.

The urethra is all that length of the canal from the neck of the bladder to the extremity of the penis. It is formed of the continuation of the inner and third coat of the bladder, which laſt forms a reticular membrane, uniting the inner membrane to the ſpongy body. It is, however, ſupported through all its length, near the bladder, by paſſing through the proſtate gland and ſphincter fibres; further forward than this, where it paſſes from the proſtate to the beginning of the ſpongy body of the urethra, it is inveſted and ſupported by firm cellular and ligamentous membranes; and in the length of the penis it is included in the ſpongy body, which extends from the bulb to the glans. It cannot be deſcribed as a cylindrical canal, for it admits of very unequal diſtention. It begins large at the neck of the bladder, where, immerſed in the proſtate gland, it forms a little ſinus; it is contracted again in a remarkable degree behind the bulb; it dilates into the SINUS OF THE URETHRA within the bulbous enlargement of the ſpongy body; it is gradually diminiſhed forward; and it may be conſidered as cylindrical forward to the point of the glans, where it is much contracted *, and where we often find calculi detained, which have paſſed the whole length of the canal.

The canal of the urethra is bedewed with mucus. The ſources of this mucus are here particularly apparent; for, beſides the general ſurface, there are large

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* Haller Com. lib. xxvii. ſect. i. § xxx. Mr. Home's Strictures.

lacunæ ſeen; into which the mucus is ſecreted, and from which, as from receptacles, it is preſſed as the urine flows. The inner membrane of the urethra is very delicate, and, when torn by the catheter, or by violent chordee, or opened by the cauſtic, bleeds profuſely.

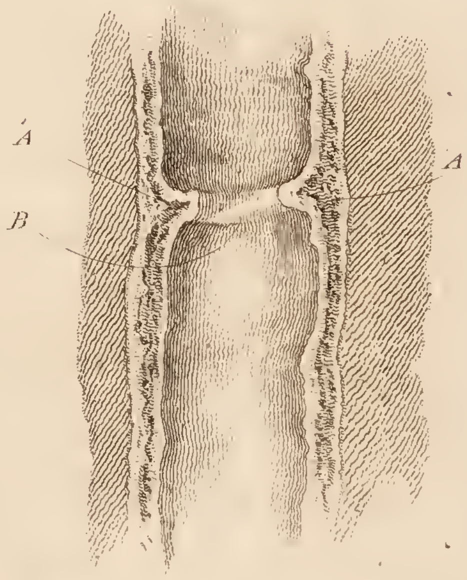
The internal membranes of the bladder and urethra are particularly ſenſible; drawing after them, when excited, not only the action of all the muſcles in the lower part of the pelvis, but having ſympathies in a particular manner with the teſticle, ſtomach, and bowels, and with the whole ſyſtem. The more curious and important effect of the injury of the urethra is the paroxyſm of fever which it induces. Obſerving the regular occurrence of an intermitting fever in caſes of fiſtula in the perineum, we ſhould imagine it to be the effect of the extravaſation of the urine in the cellular membrane, and the effect of general irritation; until it is obſerved that the ſimple ſtricture produces that effect, and that a touch of the cauſtic brings on a violent paroxyſm.

When the reticular membrane is inflamed, of courſe it loſes its elaſticity, and gives pain in erection. Sometimes the inflammation, being continued to the ſpongy body ſurrounding the urethra, makes it unequal in its capacity of diſtention to the cavernous bodies of the penis, and ſometimes their cells are united by adheſion in the worſt caſes of chordee.

I cannot imagine with ſome, that the urethra is muſcular; *firſt*, becauſe I ſee no end it could ſerve in the œconomy; *ſecondly*, becauſe there is no proof in ſupport of the opinion; *thirdly*, becauſe it is ſurrounded

rounded with ſtrong fibres and a ſpongy body, which conjointly ſeem calculated for every purpoſe of the œconomy, and likely to account for every ſymptom which might be miſtaken for ſpaſmodic action in the canal itſelf. The idea of muſcularity is derived from the ſymptoms of ſtricture and irritability of the canal. I ſhall therefore, in the firſt place, ſhew how I conceive ſtricture is produced.

The urethra is very elaſtic; not only allowing a very large bougie to be paſſed, and cloſing upon a thread, but it ſtill more remarkably admits of elongation than of diſtention in the width of the canal. It is ſurrounded, as we have ſeen, with a ſpongy body and the cellular coat which is betwixt the delicate lining membrane of the urethra, and the ſpongy body partakes of the ſtructure of both, and is very elaſtic. But when an inflammation attacks the canal, this cellular membrane is its principal ſeat. The point affected loſes its elaſticity; no longer ſtretches with the penis and urethra, but conſolidates, and throws the inner membrane into a fold in a direction acroſs the canal. Thus the membrane at A has contracted and condenſed in conſequence of inflammation, or rather, when contracted, by the ſhrinking of the urethra in length and its ſpongy body has formed an adheſion, and, in conſequence of inflammation, has loſt its elaſticity and no longer dilates in the proportion



portion of the reſt of the canal. The conſequence of this is, that the point of the inner membrane B makes a projecting ring round the urethra. To ſuppoſe this ſtricture to have been formed by the muſcular contraction in the diameter of the canal *, would be to allow the partial action of one or two fibres; (for the ſtricture is like that which would be produced by the tying of a pack-thread round the canal, being a narrow circular ridge;) which is very unlikely. Sometimes, however, the ſtricture is only on one ſide of the canal, which, allowing it to be formed as I have here ſuppoſed, is very likely to happen: but in conſequence of the muſcular action, cannot eaſily be ſuppoſed to take place, ſince the drawing of the muſcular fibres would equally affect the whole circle.

As to the effect of heat and cold on an obſtruction, it may be explained ſimply, without the ſuppoſition of muſcular contraction: for as we know that the penis, ſpongy bodies, and of courſe the whole canal, relax and elongate in warmth, as they are ſhrunk up and contracted in cold, like the ſkin of the body in general, without implying muſcular contraction: ſo we ſee how this ſtate would affect a ſtricture;—that, when the penis and the urethra was ſhrunk, the effect of the ſtricture would be increaſed, and the patient could paſs his urine only when the parts were relaxed, by ſitting in a warm room, or by the uſe of the bath.

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* "A ſtricture," ſays Mr. Home, "whether in the ſpaſmo-"dic or permanent ſtate, is a contraction of the tranſverſe fibres "of the membrane which forms the canal."

But when ſurgeons ſpeak of ſpaſms of the urethra, they ſeem to forget the action of the ſurrounding muſcles. Thus acrid and ſtimulating urine, or an irritable ſtate of the urethra, will be followed by a ſmall ſtream of urine: or perhaps a temporary obſtruction is the conſequence: but why ſhould we ſuppoſe that the membrane of the urethra, which has no appearance of muſcularity, cauſes this effect, when it is probably produced by the ſphincter muſcle, the fibres which ſurround the membraneous part of the urethra, the levator ani, and, above all, by the accelerator urinæ, a muſcular ſheath of fibres ſurrounding three or four inches of the canal. Round the membraneous part of the urethra, and behind the bulb, there is much interlacing of muſcular fibres; and the levator ani, ſplitting, embraces it. Round the ſinus of the urethra and the bulb which covers it, is the accelerator urinæ, more properly the ejaculator ſeminis: and as the ejaculator ſeminis contracts upon the ſinus, it drives onward the ſemen along the urethra, ſince the ſeminal fluids do not paſs backward into the bladder, unleſs when the action of the parts is much diſordered; there muſt be a contraction round the urethra behind the bulb during the action of the ejaculator. The ſenſibility of the glans holds a controul over the action of theſe muſcles; and the diſeaſe of the bladder and of theſe parts affects the glans. There is, in ſhort, a complicated apparatus here, and we cannot wonder, that the moſt frequent ſeat of diſeaſe is juſt at the beginning of the ſinus of the urethra, where the muſcular action is ſtronger, and the canal narroweſt. At this place is the ſtricture of the urethra moſt common, and here if ſpaſm and muſcular action ſhould bring it on, if ſpaſmodic action ſhould prevail during the permanent ſtricture, or bliſtering bring on a ſtrangury, (ſeeing that this point is ſo ſurrounded with muſcular fibres deſtined to a particular action,) we muſt not take theſe ſymptoms as indicating a muſcularity in the whole tract of the urethra. I believe it is found, that ſtricture is moſt frequent juſt behind the bulb of the urethra; where I have alleged, the muſcularity is greateſt; and alſo about the diſtance from the extremity of the urethra which anſwers to the termination of the ejaculator muſcle.

SECTION II.

OF THE TESTES.

THE TESTICLE might be conſidered as more naturally connected with the abdominal viſcera, than with thoſe of the pelvis, as its original ſeat is on the loins amongſt the abdominal viſcera, and as it receives its coats from the peritoneum, and its veſſels from the abdominal veſſels.

The teſtes are two glandular bodies which ſecrete the ſemen: they receive their veſſels from the aorta and cava, or the emulgent veſſels; their excretory duct runs up into the belly, and it terminates in the urethra near the neck of the bladder.

THE SCROTUM, in which the teſticles are lodged, is a continuation of the common integuments; its cellular membrane is particularly lax and free from fat, and anaſarca extremely apt to fall down into it, ſo as ſometimes to diſtend the ſcrotum to a tranſparent bag of enormous ſize; and not unfrequently it has been blown up to counterfeit rupture and other diſeaſes.

The cellular ſubſtance of the ſcrotum is peculiar in its appearance, being red and fibrous. It has been conſidered as a muſcle, and called DARTOS: although this is denied by many. Its action is to ſupport and brace the ſcrotum; and in bad health *, and in old age, it is ſo much relaxed as to allow the teſticles to hang upon the chords. But beſides the ſimple corrugation and relaxation, the ſcrotum has a motion like the vermicular motion of the inteſtines, from ſide to ſide, and alternately. Its contraction has a relation to the healthy ſecretion of the gland within.

Upon the ſurface of the ſcrotum, directly in the middle, there is a line paſſing from the lower part of the penis to the anus; the RAPHA. This line marks a diviſion in the ſcrotum, not ſuperficial merely; but a partition, or ſeptum, is formed, dividing the ſcrotum into two diſtinct cellular beds for the teſticles.

COATS OF THE TESTICLE. Beſides the involving ſcrotum, each teſticle has two diſtinct coats, the tunica vaginalis and tunica albuginea. The tunica vaginalis covers the teſticle looſely; that is, without adhering to its general ſurface: but the albuginea is in cloſe union with it, and is the immediate coat of the teſticle. The inner ſurface of the vaginal coat is perfectly ſmooth, and an exudation is poured out from

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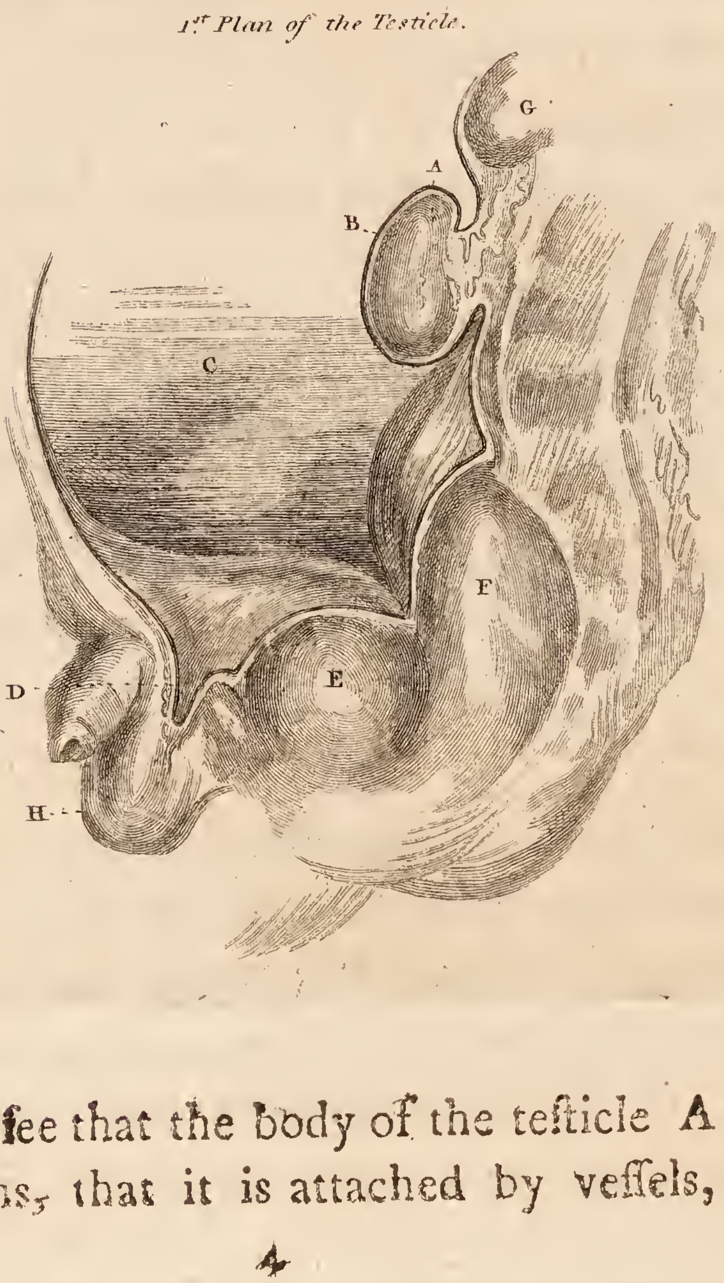
* Nurſes particularly attend to the ſtate of the ſcrotum in children.

it as from the peritoneum within the belly, the outer ſurface of the tunica albuginea is alſo ſmooth and firm, and white, whence its name. But on its inner ſurface, like the peritoneum, which covers the inteſtine, and adheres to the muſcular coat, it adheres to the tubes of the teſticle itſelf. Theſe inveſting coats are in ſome reſpects diſſimilar, yet in general much alike, being continuations of the ſame membrane, and both prolongations of the peritoneum. The outer membrane, the tunica vaginalis, is a protection to the teſticle, gliding eaſily on the inner coat, and with the mobility of the cellular membrane of the dartos it preſerves the teſticles from bruiſes and ſtrokes to which it would be expoſed if it were more firmly attached. The inner tunic, or albuginea, gives ſtrength and firmneſs to the ſubſtance of the teſticle. Betwixt theſe coats is the fluid collected, which forms the hydrocele. They alſo contain the congenital hernia; but the common hernia is without both coats of the teſticle. To underſtand the principles of anatomy of this part, we muſt attend to the deſcent of the teſticle, and to the manner in which theſe coats are formed.

OF THE DESCENT OF THE TESTICLE.

In the fœtus, ſome months before birth, the teſticles are lodged in the belly, and are in every reſpect like the abdominal viſcera. They are ſeated on the fore part of the pſoæ muſcles, by the ſide of the rectum. They are of courſe covered and inveſted by the peritoneum; for, as we have explained how the ſolid viſcera and the inteſtines are behind the peritoneum, ſo it will be underſtood how the teſticles lying on the loins are behind the peritoneum: that is to ſay, the glandular ſubſtance of the teſticle is inveſted by a ſingle coat, and that coat is the peritoneum, which, after covering the body of the teſticle, is reflected upon the loins; as the coats of the liver, for example, are to be traced from its ſurface to the diaphragm: no words, however, can well explain this ſubject, and it will be better underſtood by ſections and plans.

Firſt Plan of the Teſticle.



We ſee that the body of the teſticle A is ſeated on the loins, that it is attached by veſſels, and inveſted by the peritoneum. This ſurrounding of the body of the teſticle by the peritoneum forms that coat which is in union with its ſubſtance, and which deſcends with it into the ſcrotum, and forms the tunica albuginea.

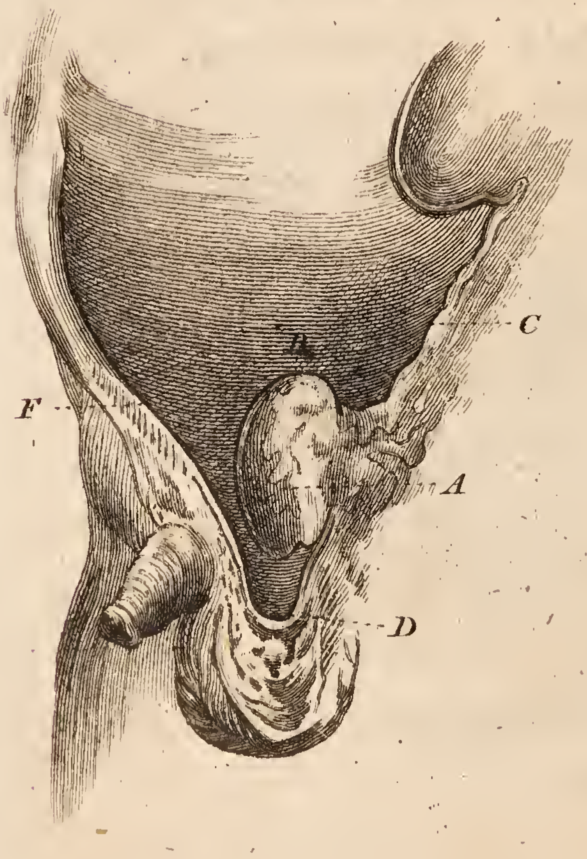
The figure and preſenting ſurfaces of the teſticle, while within the belly, are the ſame which we find after it has deſcended into the ſcrotum. It ſtands edge-ways forward, and the epididimis lies along the outſide of the poſterior edge of the teſtes. We ſee that it is attached, by the peritoneum being reflected off from its back part, and we can trace the peritoneum upwards over the kidney G, and downward over the rectum F, and bladder of urine E.

We may alſo obſerve a proceſs of the peritoneum which has paſſed through the abdominal ring, and which in this plan is marked D. Now it may eaſily be underſtood that the teſticle A, gradually ſhifting its place from its connections in the loins, drops down into this ſheath D. It will alſo be eaſily underſtood how the teſticle covered with its firſt coat B, (viz. the tunica albuginea,) when it has fallen into D, is inveſted by this ſac of the peritoneum, and that this laſt covering will come to be the tunica vaginalis. The tunica vaginalis is ſo called becauſe it covers the teſticle like a ſheath; that is, it does not univerſally adhere to the ſurface of the albuginea, as that coat does to the body of the teſticle.

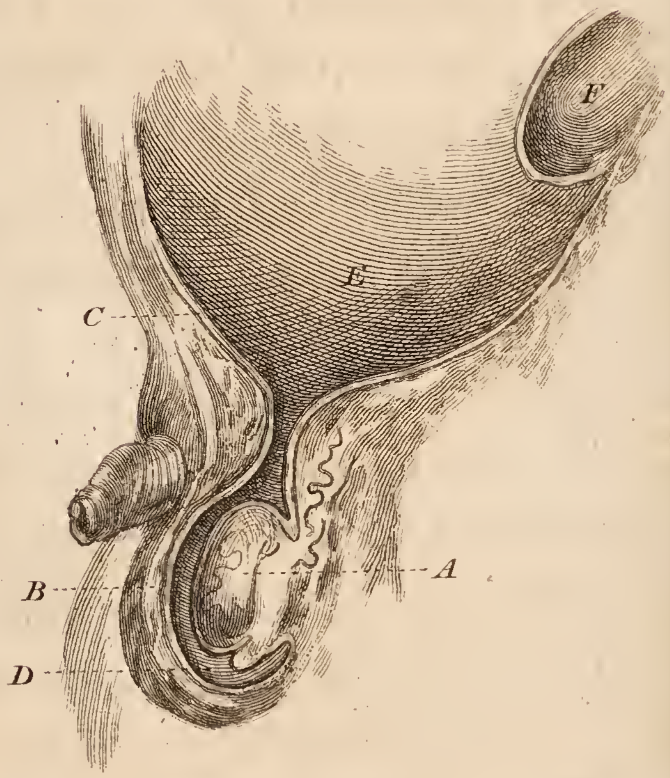
Underſtanding the nature of the peritoneum, we may learn the meaning of this looſeneſs of the outer coat of the teſticle. By turning to the introductory ſection of the abdominal muſcles, we find, that the inſide of the ſac of the peritoneum is ſmooth, and forms no adheſion; whilſt the outer ſurface, being in contact with the ſubſtance of the ſeveral viſcera, has a connection with them by a common cellular membrane. Now, as the inſide of the peritoneum does not adhere, as the ſurface of the peritoneum, (which in this firſt plan is towards C,) is ſmooth, and has no tendency to unite with the ſurface of the viſcera; ſo neither has the ſurface of the peritoneum at D, the tendency to unite with the peritoneum (or the ſurface of the albuginea,) at B, when it deſcends to meet it: conſequently the coat of the inteſtines may be repreſented in this ſecond plan, thus.

Second Plan of the Teſticle.

2d Plan of the Teſticle.



3d Plan of the Teſticle.

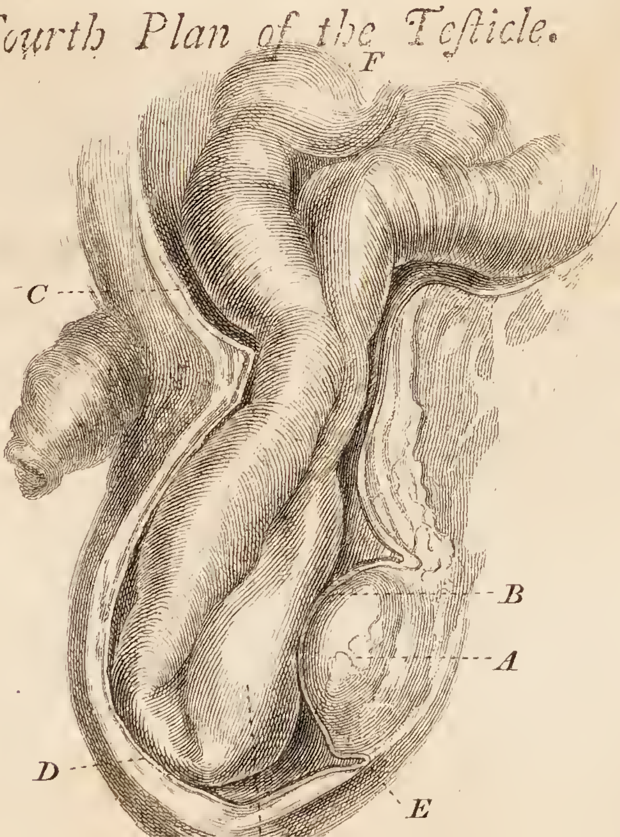


In the firſt plan, we had the ſituation of the teſticle in the fœtus repreſented. In the ſecond plan, we have the middle ſtage of the deſcent repreſented : and, in the third, we have the full deſcent. In the ſecond figure, A is the body of the teſticle, B is the firſt peritoneal covering or tunica albuginea, which can be eaſily traced, reflected off from the loins at C; again, D is the portion of the peritoneum, which having deſcended before the teſticle is preſently, when the teſticle has fully deſcended, to become the ſecond, or vaginal coat of the teſticle; F is the continuation of the peritoneum upon the inſide of the abdominal muſcles.

In the third figure of this ſeries, we find the teſticle A has deſcended into the ſcrotum; that it has one coat covering it, which we recognize to be the ſame with B, in the firſt figure, and that the peritoneum in this third plate at B, can be traced to C, the peritoneum within the belly.

Now ſuppoſing this to be the ſtate of the teſticle immediately after it has deſcended, we ſee that there is ſtill a communication betwixt the cavity of the tunica vaginalis D, and the cavity of the peritoneum E. F is the kidney, covered by the peritoneum, and nearly in the ſituation in which the teſticle was before its deſcent.

Fourth Plan of the Teſticle.



From this fourth plan of the teſticle, we may learn the nature of the congenital hernia. It is a hernia produced by the inteſtine ſlipping down, from the communication betwixt the general cavity of the peritoneum, and the cavity of the tunica vaginalis, or in conſequence of an adheſion betwixt the teſticle and a portion of the gut, which of courſe cauſes the gut to follow the teſticle, and prevents the communication betwixt the belly and the cavity of the tunica vaginalis from being ſhut. Thus, fig. 4. A, is the teſticle, as it is ſeen in plan 3d. B, the tunica albuginea; C, the peritoneum within the belly; D, the tunica vaginalis, which we can trace from C, and which is diſtended and ſeparated from the ſurface of the teſticle, (*i. e.* of the albuginea) by a portion of the gut, which has deſcended through the ring: F, the inteſtines within the belly: G, the inteſtine which has fallen into the tunica vaginalis, and is in contact with the teſticle; that is, in contact with the tunica vaginalis, which is in cloſe union with the gland, and is conſidered as its ſurface.

We have explained the change which takes place in the ſituation of the teſticle, as it relates to the peritoneum; but how this change is brought about, it is very difficult to underſtand. It is not a ſudden pulling down of the teſticle, but a very gradual proceſs, continuing for months; it is not the effect of gravitation, for the fœtus may be in every variety of poſture while in the womb, and generally the head preſents. It is not reſpiration. Is it then the effect of the action of the cremaſter muſcle? or muſt we refer it to a law ſuch as that which controuls and directs the growth of parts?

When the parts in a fœtus before the deſcent of the teſticle are diſſected, there is found a ligamentous, or cellular cord, mingled with the fibres of the cremaſter muſcle, and which takes its origin from the groin, is reflected into the abdominal ring, and ſtretches up to the body of the teſticle. This body is called ligament or gubernaculum, and to the agency of this bundle of fibres, is the deſcent of the teſticle attributed. There are, however, objections to this. If we ſuppoſe that the cremaſter muſcle, by its exertion, brings down the teſticle to the ring, How does it paſs the ring? for ſurely we cannot ſuppoſe that this muſcle, which takes its origin from the internal oblique muſcle, conſequently within, can contract, not only ſo as to bring the teſticle to the very point of its origin, but to protrude it paſt that point, and through the tendon of the external oblique muſcle. Again, animals have the cremaſter muſcle, whoſe teſticles never deſcend out of the belly;—again, the veſſels of the cord, before the teſticle has fully deſcended, ſhow no marks of being dragged down, for they are elegantly tortuous.

As the teſticle paſſes very ſlowly from the loins to the ring; ſo, after it has eſcaped from the belly, it paſſes ſlowly from the ring to the bottom of the ſcrotum. It commonly remains ſome time by the ſide of the penis, and only by degrees deſcends to the bottom of the ſcrotum *.

In

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* Mr. Hunter has ſhewn, that the detention of the teſticle in the belly is in conſequence of ſome defect and want of action in the

In this change the teſticles do not fall looſe into the elongation of the peritoneum like a piece of gut or omentum in a rupture;—but, carrying the peritoneum with them, they continue to adhere to the parts behind them, as they did to the pſoas muſcle while in the loins: a point of importance to be recollected by the young ſurgeon.

The communication betwixt the belly and the ſac of the vaginalis is very ſoon obliterated by the adheſion of the upper part, and then the whole extent of the paſſage (viz. from E to D, in plan 3d of this ſeries,) is ſhut. When this proceſs is prevented in the firſt inſtance, when nature is baulked in the humour of doing her work, as Mr. Hunter obſerves, ſhe can not ſo eaſily do it afterwards.

It has alſo occurred that, this communication remaining after birth, a hydrocele has been produced by the diſtention of the tunica vaginalis, by fluids deſcending from the belly. The character of ſuch a tumour will be, that the fluid will be eaſily forced into the belly. It may, however, be miſtaken for a congenital hernia *.

It will already be underſtood, that in the common hernia of the groin or ſcrotum, the gut does not paſs by the communication from the belly into the vaginal coat;

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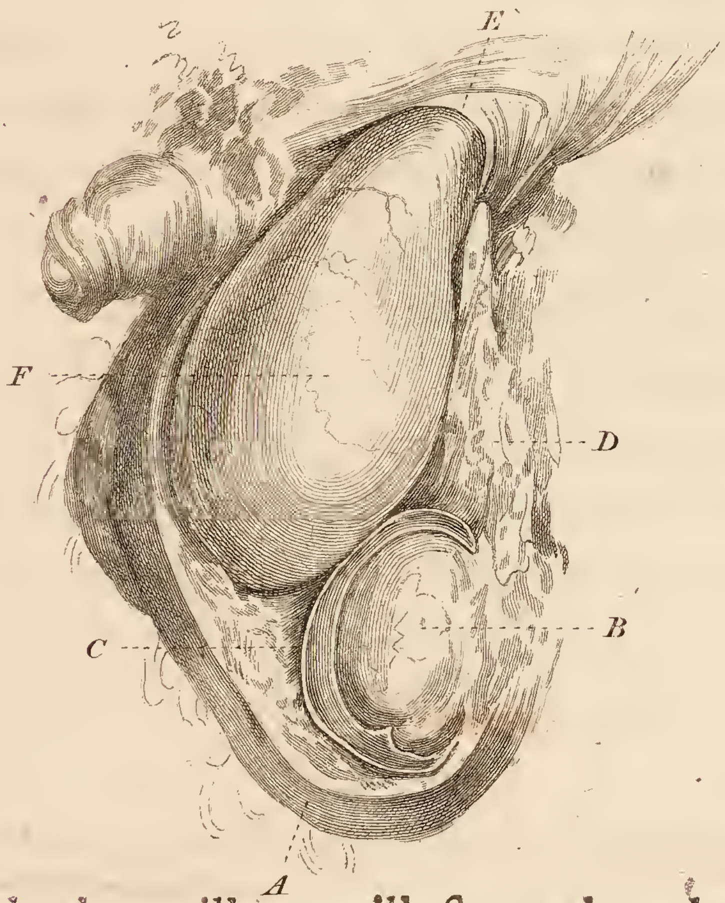
the teſticle, and that thoſe who have the teſticle remaining in the belly have it imperfect or ſmall. This is contrary to an old authority:—The teſticles are ſeated externally, "for chaſtity's "ſake, for ſuch live-wights as have their ſtones hid within "their body, are very lecherous, do often couple, and get "many young ones."

* Such is the remark of Mr. Hunter.

coat; that ſuch communication no longer exiſts, and that when there is a rupture from preternatural wideneſs of the abdominal ring, or in conſequence of a great violence, a new portion of the peritoneum deſcends with the gut before the cord of the teſticle.

Fifth Plan of the Teſticle.

Hernial.



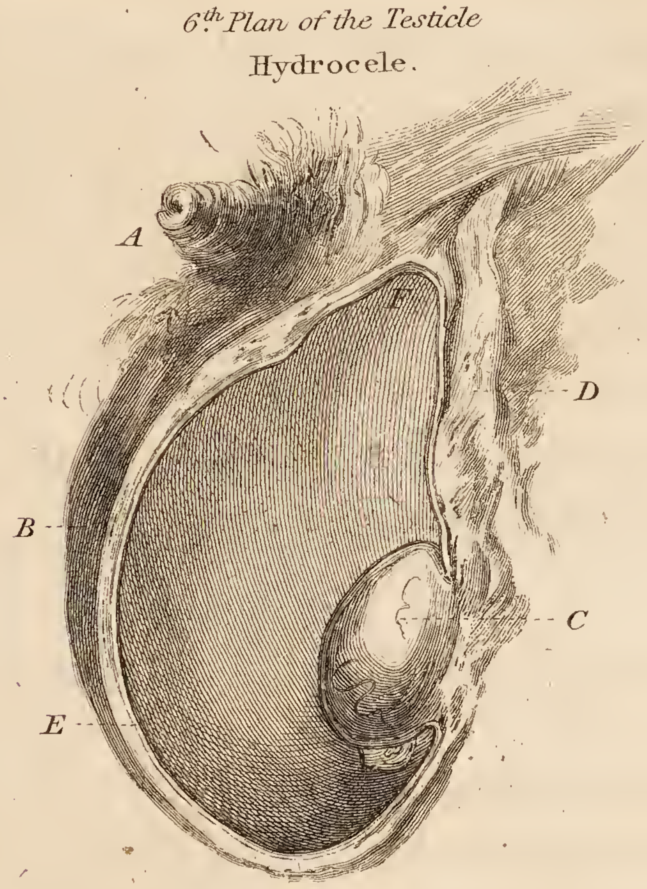
This 5th plan will now illuſtrate the relation of the teſticle to the herniary ſac in the common ſcrotal hernia. A, the ſcrotum: B, the teſticle; which will be eaſily underſtood to preſerve its attachment to the back part of the ſcrotum: C, the tunica vaginalis, which here inveſts the teſticle, but which is not now (in the adult or perfect ſtate of the coats of the teſticle), as is ſeen in plan 3d, open from D to E, but forms a ſhort ſac ſurrounding the tunica albuginea: D, the cellular membrane of the cord of veſſels paſſing down to the teſticle. And now there are no remains of the tube of communication betwixt the belly and vaginal cavity; it is obliterated and reſolved into this cellular membrane.

We ſee then, that in this plan the teſticle and its coats, and the ſpermatic cord, are in their natural ſituation, and that the herniary ſac has deſcended before them. E, is the ring of the external oblique muſcle of the abdomen, through which not only the teſticle, with its coats and veſſels, has deſcended, but alſo the hernia: F, the herniary ſac, which contains a portion of the gut; it is formed of the peritoneum, fallen down from the belly, but it is quite diſtinct from the ſac of the tunica vaginalis C. Whilſt this new proceſs of the abdominal peritoneum has deſcended, it has contracted adheſions, and cannot now be replaced.

In thus explaining theſe important principles of anatomy, and which the anatomical ſtudent will find wonderfully to facilitate the more minute ſtudy of ſurgical anatomy, it only remains to ſhow the nature of the hydrocele.

The hydrocele is a collection of water within the ſac of the tunica vaginalis; that is, betwixt the tunica vaginalis and tunica albuginea. For, as we have ſeen, that the ſame ſurface of the vaginal coat is contiguous to the ſurface of the teſticle (viz. the albuginea,) with that of the peritoneum, which is contiguous to the viſcera of the belly; and as it has the ſame exudation, ſo it has the ſame diſeaſe, viz. a collection of water, from the abſorption being diſproportionate to the exudation. When the tunica vaginalis is diſtended with the water of a hydrocele, the teſticle is towards the back part of the ſcrotum; it can be felt there; and when the ſcrotum is placed betwixt the candle and the eye, we ſee the tranſparent ſac on the fore-part of the tumor, the opaque maſs of the teſticle behind; generally the diſtended vaginal coat ſtretches up before the cord conically. Thus,

Sixth Plan of the Teſticle.



A, the penis; it is generally corrugated thus, in conſequence of the diſtention of the ſcrotum in ſcrotal hernia and hydrocele: B, the ſcrotum: C, the teſticle, covered only by the tunica albuginea: D, the cellular membrane of the cord: E, the tunica vaginalis, diſtended with the water of the hydrocele, and conſequently ſeparated from the ſurface of the teſticle: F, that part of the ſac of the vaginal coat, which often extends conicaly before the cellular membrane of the cord D. Now we ſee that the diſtention of the vaginal coat does not open up the old communication with the belly; but that, the former communication being ſhut, and the peritoneum there degenerated into the cellular membrane of the cord, the hydrocele is a diſtinct ſac, ſurrounding the teſticle, and formed of the tunica vaginalis.

To underſtand this ſubject of the coats of the teſticle, it is not neceſſary merely to conſider the deſcent of the teſticle; but the ſtudent muſt conſider it in every point of view, turn it as it were into every variety of poſture, without which his difficulties will perpetually return upon him. It is for this reaſon that I have endeavoured to repreſent ſimply the various ſtates of the coats of the teſticle in diſeaſe.

OF THE VESSELS OF THE CORD AND TESTICLE.

In attending to the deſcent of the teſticle, we have a cue alſo to the vaſcular ſyſtem. If we did not know that the teſticles were originally placed in the loins within the belly, we might wonder at the length and origin of the ſpermatic veſſels.

THE SPERMATIC ARTERY riſes from the fore-part of the aorta, below the emulgent artery, or from the emulgent artery, (generally on the right ſide,) and ſometimes from the arteries of the renal capſule: ſometimes there is only one, ſometimes there are two ſpermatic arteries. This artery, which the cord receives from the aorta or emulgent, is called the ſuperior ſpermatic artery, becauſe there is another which riſes from the hypogaſtric artery: this branch runs upward, connected to the vas deferens, as it riſes out of the pelvis.

Theſe arteries, taking their courſe under the peritoneum, join the faſciculus forming the cord, and ſupply the cord, and ſend twigs to the inveſting peritoneum; they then paſs through the abdominal ring, and in their courſe they are beautifully tortuous.

THE VEINS of the teſticle riſe on the right ſide from the trunk of the cava, a little below the emulgent vein, and from the emulgent vein on the left ſide. In the origin of theſe veins there are frequent varieties; there is alſo, accompanying the vas deferens, a vein, which joins the internal iliac vein. Theſe veins, in their courſe from the teſticle, are protected from the column of blood, and from the bad conſequences of compreſſion, by numerous valves. Theſe valves are very ſtrong, and will bear a great column of mercury before they give way or burſt. This plexus of convoluted veins of the cord is the moſt beautiful in the body. This convoluted ſtate of the veins is ever attendant on great activity and exertion of the arteries of the part. If there is a proviſion in the ſhape, courſe, and ſtrength of the arteries, for occaſional acceleration of the blood through them; ſo will there be found in the veins a tortuous and varicoſe appearance; and again, if by accident there is excited an uncommon action in the arteries of a living body, that action will be apparent from the diſtended or enlarged ſtate of the veins. In the teſticles of ſuch animals as have their ſeaſons, the artery and veins of the teſticle are ſtill more convoluted, and form a maſs of veſſels, which has been called the corpus pyramidale *.

The nerves of the teſticle, like the blood-veſſels, come from the loins, and are continued down upon the veſſels in the ſpermatic plexus. This ſtill farther allies the teſticle to the abdominal viſcera, giving them much of the ſame ſympathies. The ſtomach, inteſtines, and teſticle, ſympathiſe readily with each other. As we find the tunica albuginea of the teſticle to be very firm, denſe, and unelaſtic, the great pain in inflammation of the teſticle has naturally been attributed to the reſiſtance made by this coat to the ſwelling of the ſubſtance of the teſticle, but much muſt be aſcribed to the natural ſenſibility of the part, independently of ſwelling and tenſion; for in the very moment of a blow, a perſon faints and falls down from exquiſite pain.

The lymphatics of the teſticle are numerous, and eaſily demonſtrated by blowing up the cellular ſtructure of the body of the teſticle; and we ſhall by-and-by find, that this has been the ground of diſpute between phyſiologiſts; and the proofs of ſome important points in the doctrine of abſorption have been drawn from the injection of the lymphatics of the teſticle and cord.

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* Corpus varicoſum,—Corpus Pampiniforme; Galen de Semine. Alias paraſtatam varicoſam, Hall.—As the old phyſiologiſts ſaw and obſerved this wonderful tortuoſity, and the tendril-like form of the ſpermatic artery, they thought that as there muſt be ſomething peculiar in this ſtructure, the blood was here begun to be changed into ſemen, and therefore they called them the vaſa preparantia.

THE CREMASTER MUSCLE, as we have ſeen in the firſt volume, takes its origin from the internal oblique muſcle of the abdomen, and, paſſing down over the veſſels of the cord, is expanded on the tunica vaginalis: its uſe is to ſuſpend the teſticle, and prevent it from dragging upon the veſſels of the chord.

By conſtitutional weakneſs, or the relaxation induced by warm climates, this muſcle becomes relaxed, and artificial ſuſpenſion becomes neceſſary. Sometimes this muſcle draws the teſticle ſpaſmodically to the groin; yet I cannot allow that this is the muſcle which retracts and corrugates the ſcrotum, for the teſticle will be thus drawn up by the cremaſter, without corrugation or contraction of the ſcrotum. In ſome this would appear to be a voluntary muſcle; it poſſibly accelerates the motion of the ſemen, or at leaſt promotes its ſecretion.

Thus we find the cord of the teſticle, as it is called, to conſiſt of the arteries, veins, and nerves; of the lymphatics returning from the teſticle; of the cellular tiſſue embracing and ſupporting all theſe veſſels; and laſtly, of the fibres of the cremaſter muſcle.

OF THE STRUCTURE OF THE TESTICLE.

It is to De Graaff that we owe the knowledge of the ſtructure of the teſticle; and indeed the merit of this great anatomiſt has not been acknowledged with ſufficient gratitude by modern anatomiſts: but after the fervour of diſputation has ſubſided, the merit of ingenuity and of diſcovery muſt return to him to whom it is due. No one more highly values than I do the improvements of anatomy by the Hunters and Monro: but I muſt ſay, that the ſtructure of the teſticle was demonſtrated by De Graaff to his fellow anatomiſts of Montpelier, and his diſcoveries publiſhed in a manner ſo perfect, as to leave us little to learn from more modern authors.

De Graaff, by exciting animals to venery, and tying the ſpermatic cord, had the ſeminal veſſels diſtended. He did not depend upon injections; by maceration and diſſection in this diſtended ſtate, he unravelled all the intricacies of their tubes. More modern anatomiſts have proved the truth of his obſervations by injections of mercury, and have ſucceeded in a variety of ways of preparing the teſticle.

Tubuli testis.—When the tunica albuginea teſtis is lifted, the body of the teſticle is found to conſiſt of innumerable very delicate white tubes; which, when diſentangled from the minute cellular membrane which connects them, and floated in water, exhibit a moſt aſtoniſhing extent of convoluted veſſels. By a cloſer attention, however, to this ſtructure before it is thrown into confuſion by pulling out the tubes, they appear to be regularly laid in partitions of the cellular membrane. Theſe ſepimenta are very regular in ſome animals, and while they ſeparate the ſeminal tubes, they ſupport and convey the blood-veſſels to the ſecretion of the ſemen. Dr. Monro has denied the formal diviſions which De Graaff had engraved, but acknowledges them leſs regular, leſs eaſily found, and not ſo limited in their number; nor does he find them to prevent all communication betwixt the tubes of the teſticle.

Theſe ſeminiferous tubes of Haller, or tubuli teſtis of Monro, running in meſhes, 15 or 20 in number, terminate on the back of the teſticle. Each of theſe tubes ſeems to be cylindrical, or of one diameter throughout their whole extent: we ſee no communication betwixt them; no branches given out or going into them; no beginning for the whole, nor for any one of them. Though we cannot prove it, yet there ſeems to be only one tube wonderfully convoluted and folded up in each ſubdiviſion of the teſticle.

Rete testis.—When the tubuli come out from the body of the teſticle, they run along the back of it, and communicate by inoſculations with each other, ſo as to form a net-work of veſſels, from which appearance Haller named them rete teſtis.

Here it often happens that the mercury ſtops, when it has been injected backward from the vas deferens; and it is this part which has been better deſcribed and drawn, in conſequence of mercurial injections, than it was by De Graaff; for he, as we have ſaid, ſaw this part only filled with ſemen.

Connected with the rete teſtis is the corpus highmorianum.—Where the lines of the membranous ſepta, and cellular membrane of the teſticle, meet on the back of the teſticle, and under the epididimis, they form a white line. This white line running along the teſticle, was ſuppoſed by Highmore to be a hollow tube; it was compared with the ſalivary duct; it was thought to be a cavity leading from the body of the teſticle to the head of the epididimis, and to form the communication by which the ſemen flowed from the teſticle. De Graaff firſt refuted this notion, and ſhewed that it was not by this one great duct, but by theſe ſmaller tubes forming what has been now called the rete teſtis, that the ſemen came from the teſticle: ſtill it had continued a queſtion, whether this white line was really ſolid, or a tube; and upon faithful examination of the point it appears, that this is expreſsly as it was explained by De Graaff, viz. that it is a mere collection of the membranes of the body of the teſticle, forming a linea alba; and as the ſepta are more diſtinguiſhable in ſome animals, ſo is the corpus highmorianum *.

VASA EFFERENTIA.—The tubes running on the back of the teſticle, and forming the rete teſtis, we have underſtood to ariſe from the tubuli teſtis; now it is the continuation of the rete teſtis which is called vaſa efferentia. The vaſa efferentia are very delicate veſſels which run out from the head of the teſticle, ſingle at firſt, but they are ſoon convoluted, and by theſe convolutions they are formed into an equal number of vaſcular cones, which conſtitute the head or larger part of the epididimis. Theſe vaſa efferentia and vaſcular cones are connected by a very delicate cellular membrane; and it is a piece of very nice diſſection to diſplay them after they are injected with mercury.

EPIDIDIMIS.—The vaſa efferentia, after forming thin conical convolutions, unite and form larger tubes; theſe again uniting, form one large excretory duct, the *vas deferens:* but this veſſel being convoluted to a wonderful degree, forms a body, which, being as it were, placed upon the teſticle, has been called epididimis.

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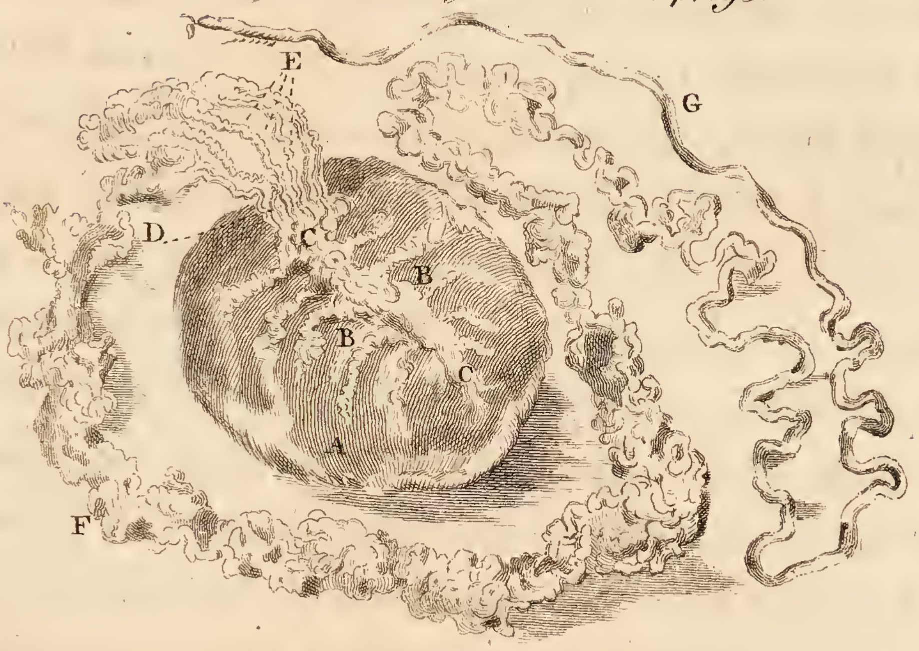
* This body called a mere *firmamentum* or binding, Winſlow; the nucleus teſtis.

~~Fifth~~ Plan of the Teſticle.



7th Plan of the Testicle. p. 195.

In this repreſentation of the diſſected teſticle, A is the body of the teſticle diveſted of its coats; B, the tubuli teſtis *; CC, the rete teſtis; D, the vaſa efferentia; E, the vaſcular cones; F, the epididimis formed of the convolutions of the vas deferens; laſtly, G is the vas deferens.

In the ſubſtance of the teſticle there are no glands nor folicules; the arteries minutely ramify amongſt the ſeminal tubes, and, there is reaſon to believe, ſecrete the ſemen into them. The ſeminal veſſels in the ſubſtance of the teſticle, or tubuli teſtis, run together upon the ſurface of the teſticle, and form the rete teſtis. From the rete teſtis are continued the vaſcular cones: theſe convolute, and running together form the epididimis; from which the tube is continued under the name of the vas deferens. It paſſes up the chord; enters by the ring into the abdomen; and then paſſing down into the pelvis, terminates in the veſiculæ ſeminales, in a manner preſently to be explained. It is not likely that the vis a tergo, the power of the arteries, puſhes the ſemen through all this length of tube, of which the epididimis itſelf is reckoned to be ſeveral feet in length, if the various convolutions were undone. Such an action on the teſticle as that of the dartos or cremaſter muſcle, could give only a general ſtimulus, but could not force on the ſemen in tubes which take ſo a great a variety of directions. We are therefore left to the ſuppoſition, that theſe tubes themſelves have a power of accelerating the fluids through them.

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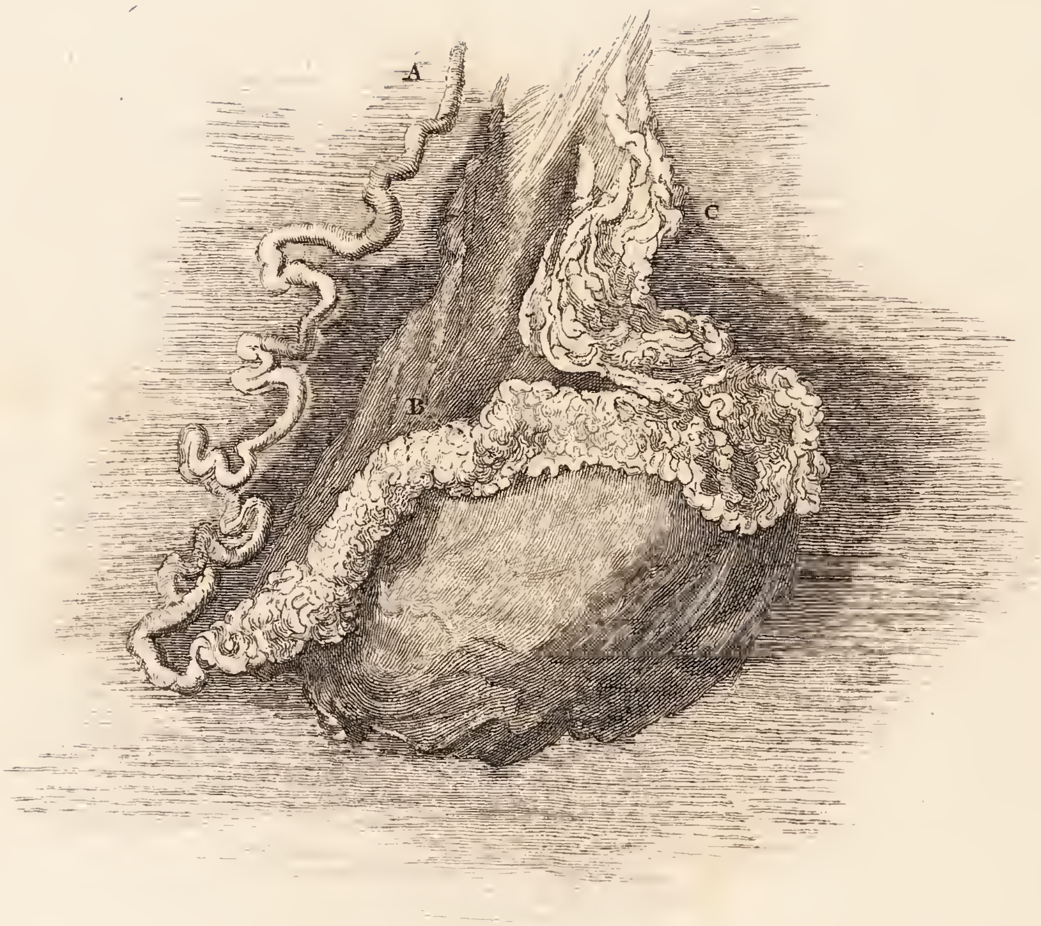
* Where the tubuli are emerging to form the rete vaſculoſum, they are called the *vaſa recta.*

Of the lymphatics of the teſticle we ſhall afterwards treat; it is, however, neceſſary here to remark, that Prochaſka found in his injections a difficulty in making the mercury paſs the rete teſtis into the teſticle. Obſerving at the ſame time in his preparations, and in the drawings of all authors, an appearance of irregularities in this part like the valvular ſtructure of lymphatics, he has been led to ſuppoſe that there is a proviſion here for preventing the ſemen from being forced backward into the teſticle by the action of the cremaſter muſcle; he conceives that when the cremaſter muſcle draws up the teſticle to the groin, it may accelerate the ſemen in the epididimis, whilſt this valvular ſtructure prevents the regurgitation upon the delicate veſſels of the ſubſtance of the teſticle.



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The annexed plate repreſents the appearance which I have found in my preparations. A, the vas deferens by which the mercury was injected; B, the epididimis; C, veſſels running up the chord from the great head of the epididimis.

There is a duct which ſometimes ariſes from the epididimis, and which has been found to terminate abruptly in a blind end—of this, Mr. Hunter ſpeaks in the annexed note *.

OF THE TESTICLE IN GENERAL.

The teſticle is of an oval form, and of the ſize of a pigeon's egg: it is a little flattened on the ſides: it

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* "By a ſupernumerary vas deferens, I mean a ſmall duct, which ſometimes ariſes from the epididimis, and paſſes up the ſpermatic chord along with the vas deferens, and commonly terminates in a blind end, near to which it is ſometimes a little enlarged. I never found this duct go on to the urethra, but in ſome inſtances, have ſeen it accompany the vas deferens as far as the brim of the pelvis. There is no abſolute proof that it is a ſupernumerary vas deferens; but as we find the ducts of glands in general very ſubject to ſingularities, and that there are frequently ſupernumerary ducts, there being often two ureters to one kidney, ſometimes diſtinct from beginning to end, at other times both ariſing from one pelvis; theſe ducts, ariſing from the epididimis, I am inclined to believe from analogy, are of a nature ſimilar to the double ureters. They reſemble the vas deferens, as being continuations of ſome of the tubes of the epididimis, are convoluted where they come off from it, and afterwards become a ſtreight canal paſſing along with it for ſome way, when they are commonly obliterated.

"The idea of their being for the purpoſe of returning the ſuperfluous ſemen to the circulation is certainly erroneous, from their being ſo ſeldom met with, and ſo very ſeldom continued further than the brim of the pelvis."

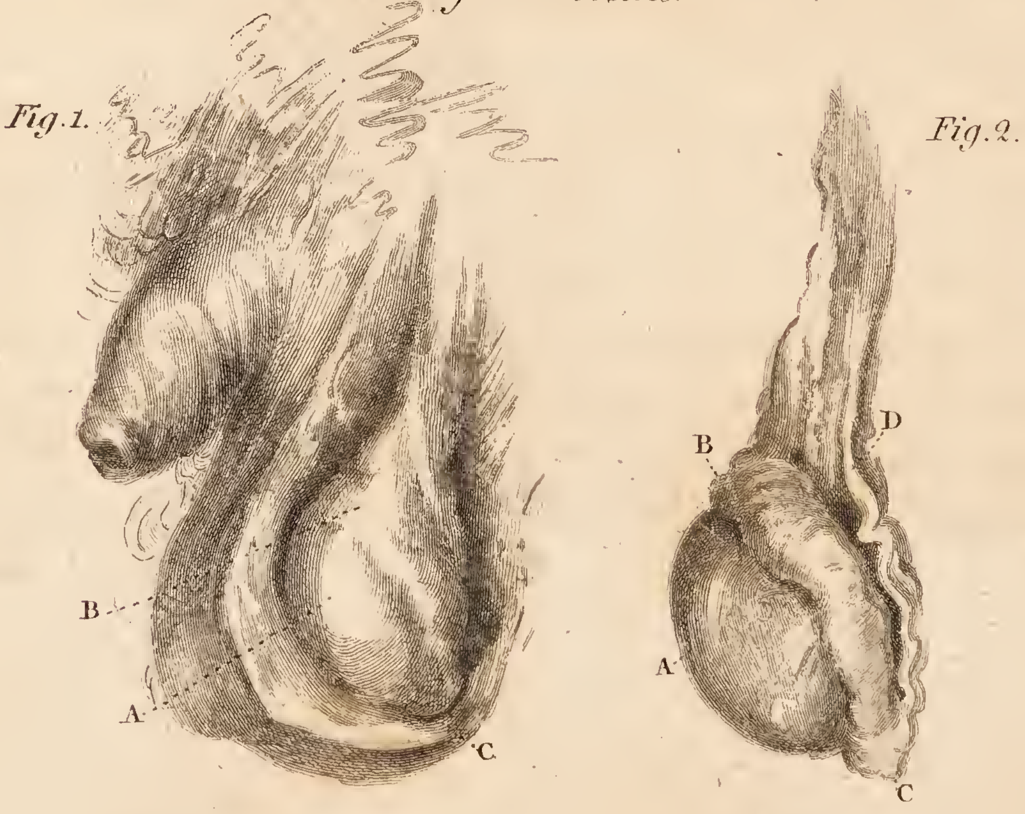
hangs

hangs in the ſcrotum by the ſpermatic chord; one end of the oval, forward and high; ſee plan 8th B; while the other is backwards, and drops lower, C. The ſpermatic chord conſiſts of the artery which brings blood; of the veins which return it; of the vas defferens, which carries the ſemen to the veſiculæ ſeminales at the neck of the bladder; of lymphatics, which are eſſential to the ſtructure of every part. This chord of veſſels comes down from the belly, and paſſes by the ring of the abdominal muſcles; it is about four inches in length, and is fixed into the upper and fore part of the body of the teſticle.

The body of the teſticle is eaſily diſtinguiſhed, and is the place where the ſecretion is performed. It is ſtrictly the body of the gland, while the part above it is only the duct by which its fluid is diſcharged.

The ancients called the teſticle dydimi, gemini, twins; they, therefore, called that part which is laid on the back of the teſticle epididimis, as added to it. To the ſurgeon, it is eſſentially neceſſary to attend to the relation of the parts of the teſticle as felt through the ſcrotum.

Eighth Plan of the Teſticle.



In this 8th plan, fig. 1. we ſee the teſticle as in its natural ſituation, covered with its membranes, and appearing like one body; while, in the ſecond figure, it being repreſented freed from its outer coat, we ſee the epididimis as laid upon the teſticle, and conſiſting of the convoluted tube. Firſt, we obſerve A, the body of the teſticle; B, the beginning of the epididimis, or the large head of the epididimis *. Then we ſee it laid alongſt the back of the teſticle, and obſerve C to be the ſmall head of the epididimis †, where the tube is reflected to reaſcend upon the teſticle, and to form D, the vas deferens.

Now, we have to obſerve, that the point C, fig. 2. or ſmall head of the epididimis, hangs over the teſticle, and points backwards to the perineum, and can be felt through the whole coats; and that the body of the teſticle A, is towards us when we examine a patient.—Further, as the letters in figure 1 and 2. refer to the ſame points, we have only to notice the fainter indication of the parts in fig. 1. it being inveſted with the coats; and to obſerve the general relation of the teſticle to the ſcrotum and penis.

There is one other circumſtance to be obſerved, viz. that the epididimis is always laid on the outer ſide of the inſertion of the chord into the teſticle; from which we diſtinguiſh, with eaſe, in a preparation, to which ſide the teſticle belongs. Thus, in the an-

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* *Globus major*, or head.

† *Globus minor canda.* This part we often diſtinguſh retaining its hardneſs after the ſubſiding of the general ſwelling of hernea femoralis. From this point we can trace all the connections of the other parts.

nexed plans, the teſticle of the left ſide is repreſented, which we know from the points c, being directed backward, while the epididimis is laid along the left ſide of the inſertion of the chord.

OF THE VESICULÆ SEMINALES.

Behind the proſtate gland, and attached to the loweſt part of the urinary bladder, lie two ſoft bodies, which are the veſiculæ ſeminales. They appear like ſimple bags when ſeen from without, but diſſections ſhow them to conſiſt of a cellular ſtructure; each of theſe bodies is about three fingers-breadth in length; their backmoſt point is large and round, and, at the ſame time, that they diverge from each other, their narrow points unite, or are contiguous to each other forwards, and enter at the back part of the baſe of the proſtate gland.

As we have ſeen, the peritoneum does not deſcend far enough betwixt the bladder and rectum to cover or inveſt theſe veſiculæ; they are therefore involved in the cellular texture, and covered with ſtrong fibres, beſides being ſubject to the compreſſion of the levator ani muſcle. When the veſiculæ are cut into, and eſpecially when they are diſtended, dried, and cut, they preſent a cellular appearance; but if they are carefully diſſected, they preſent the appearance of a ſmall blind inteſtine convoluted.

This cellular appearance is given by the duplication of their inner membrane, together with the diſtortions and curves of the canal. Their outer ſurface is covered with a fine membrane, which, like a frenum, connects theſe cellular convolutions.

Theſe are copiouſly ſupplied with arteries; their ſurface is covered with veins and lymphatics when theſe veſſels are minutely injected, and their coat is thick and ſpongy. Heiſter, Winſlow, and others, have deſcribed ſmall glands as ſeated in their ſinuoſities; but theſe are confidently denied, and in their place there is deſcribed a pile or efflorefcence. There can be little heſitation in affirming, that theſe veſiculæ are themſelves glands, or, in other words, that the arteries ſecrete into them a peculiar fluid. The fore-part of each of the veſiculæ, which we have ſaid ſink into the back part of the proſtate gland, runs under the neck of the bladder, and opens by diſtinct mouths into the urethra, on the ſurface of the verumontanum.

The connection of the vas deferens with the veſiculæ, is very particular, it does not open directly into them, but opens with them into the urethra in ſuch a way, that the ſemen from the teſticle can paſs into the veſiculæ, though its direct courſe is into the urethra *.

If air is blown into the vas deferens, the veſiculæ will be diſtended at the ſame time that the air paſſes into the urethra: the union of the extremities of the vas deferens and veſiculæ, forms a kind of ſeptum betwixt them.

The extremity of the vas deferens joins the duct of the veſiculæ where it is imbeded in the proſtate

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* See explanation of plate III.

gland; the union of the vas deferens and duct of the veſiculæ is not attended with an enlargement of the duct; on the contrary, as the duct paſſes forward deep into the ſubſtance of the gland to arrive at the urethra, it becomes remarkably narrower until it opens in a very ſmall orifice in the verumontanum, as we ſee repreſented in the third plate. The duct (if we may ſo call it,) of the veſiculæ paſſes a full inch forward into the gland before it terminates in the urethra.

Theſe veſiculæ have been in general ſuppoſed to be receptacles for the ſemen; but as this is an opinion depending on the connection of theſe bags with the extremities of the vas deferens, and as comparative anatomy ſhows many inſtances of theſe veſiculæ being unconnected with the ducts of the teſticle, there is much reaſon to doubt whether they really are merely reſervoirs. They have always appeared to me as uſeful in adding a fluid to the ſecretion of the teſticle, which being poured together into the ſinus of the urethra, give a diſtention, exciting and giving effect to the contraction of the ejaculator ſeminis: For unleſs there were a proviſion of fluid ſufficient to diſtend the ſinus of the urethræ, the ſemen could not be thrown out from the urethra. This ſuppoſition is not oppoſed by the facts ſtated by Mr. Hunter, that in many animals the veſiculæ and vaſa deferentia open by diſtinct foramina into the urethra, becauſe in that caſe the fluids of theſe ſecreting bags might be equally mingled with the ſemen in the ſinus of the urethra, although they do not flow from the ſame tube.

VERUMONTANUM.—The verumontanum, or caput galinaginis, is an eminence on the lower part of the urethra, where it is ſurrounded by the proſtate gland. As we obſerve in the drawing, it is larger and round towards the bladder, and ſtretches with a narrow neck forwards. On its ſummit, the two orifices of the ſeminal veſſels open; and around it there are innumerable leſſer foramina and mucous folicules.

PART THE THIRD.

OF THE FEMALE PARTS OF GENERATION.

THE ANATOMY OF THE PARTS IN THE FEMALE PELVIS.

THERE is conſiderable difficulty in preſenting ſuch a view of the anatomy of the parts of generation in woman, as may bear a due relation to this general ſyſtem of anatomy, and, at the ſame time, be intelligible and complete. The ſubject is in itſelf extenſive and important, ſufficient to fill ſeveral volumes: it is much connected with practice; and the phænomena and diſeaſes of the ſyſtem ſerve greatly to illuſtrate the ſtrict anatomy of the parts. I cannot here be allowed to give to it its due importance, whilſt yet it is a ſubject not eaſily underſtood from a ſhort abſtract.

The parts of generation are divided into the external, which are thoſe without the pelvis; and the internal, or viſcera of the pelvis, and which lie within the bony circle of the pelvis.

CHAP. I.

THE EXTERNAL PARTS OF GENERATION.

THE external parts of generation are the mons veneris, labiæ, clitoris, nymphæ, urethra, hymen, or carunculæ myrtiformes. Upon theſe ſubjects we have no want of books and information; for accoucheurs of the old ſchool dwelt upon the deſcription with particular accuracy. Theſe parts were within their ken, which we cannot ſay of the viſcera of the pelvis: and, therefore, upon the former we ſhall be more brief.

In very young children theſe external parts bear a large proportion to the body, greater than at any ſubſequent period before the age of puberty. At puberty they are ſuddenly and completely evolved, and acquire an increaſe of ſize; while, from the age of two years to twelve or thirteen, there has been little increaſe. Immediately before menſtruation, commences the connection which occaſions, or accompanies that flux. It begins to effect the evolution of the uterine ſyſtem, and to fit it for its peculiar function. The parts become turgid and vaſcular; the fat is depoſited in the ſurrounding cellular membrane. About the fortieth year, when the menſes diſappear, this fullneſs of the private parts alſo ceaſes, and the fat is reabſorbed.

The MONS VENERIS is that prominence on the ſymphyſis pubis, which conſiſts of the ſkin raiſed and cuſhioned up by the fat incloſed in the cellular membrane.

brane. There is of courſe a great variety in its ſize. In early life it is ſmall: it becomes, as we have ſaid, more prominent at the age of puberty; in fat women it is of an enormous ſize; and in ſome warm climates a particular laxity prevails. From the hair on this part, marking the age of puberty, it is called pubis. As the lax texture admits of diſtenſion with the fluid of anaſarca, it is ſometimes from this cauſe very greatly ſwelled.

THE LABIÆ. Theſe are often named alæ, from a ſlight reſemblance to wings, and they are alſo called externæ, magnæ, or majores, from their place, and from their ſuperiority in reſpect of ſize over the nymphæ. The labiæ ſeem to be the mons veneris continued downward, and laterally until meeting below, they form the vulva; at their lower angle, by their union, they form the fourchette, or frenum labiorum. The ſtructure of the labiæ is ſimilar to that of the mons veneris; ſometimes one is larger than the other.

The great ſenſibility of the membrane which lines the inſide of the labiæ, requires ſome defence, and therefore the whole ſurface is amply ſupplied with mucous folicules and glands. The labiæ are a protection to the other ſoft parts, ſo neceſſary, that the clitoris, or nymphæ, when they project beyond them, are ſubject to violent inflammation.

The parts here have either ſuch folds, or are of ſo lax a texture, as to permit a great degree of diſtention during the paſſage of the child. But, as the labiæ have no muſcular power, and depend entirely on their elaſticity for reſtoring them to their original ſize, they commonly, after being very much dilated, remain in ſome degree larger and more lax. It is different with muſcular parts, as the orificium externum, which, by the power of its ſphincter, is reſtored after labour to its original ſize. In man, hernia deſcends from the abdominal ring into the ſcrotum; but, in woman, when there is a rupture from the ring, (which is rare) it may fall into the labiæ, though, I believe, it will be ſeldom found to deſcend thus far.

THE NYMPHÆ are named labiæ vel alæ minores, or labiæ internæ, to diſtinguiſh them from the great labiæ. They are like a miniature repreſentation of the great labiæ; they are covered with a very delicate membrane, and have great ſenſibility. They begin immediately under the glans clitoridis, and ſeem to be only an extenſion of its preputium, formed by a folding of the membrane. Their ſize varies much. They commonly ſtretch downward, and backward to the middle of the orifice of the vagina; ſometimes no further than to that of the orificium urethræ, and in a few inſtances they extend even the length of the fourchette *. They are very vaſcular, and have ſomewhat of a cellular ſtructure, and thus partake of a degree of turgidity, in conſequence of irritation and vaſcular action. The moſt modeſt of the uſes aſcribed to them is, that of directing the ſtream of urine. As they are obliterated during the paſſage of the child's head through the vulva, it is probable that they facilitate the neceſſary dilatation.

The nymphæ are, in their natural ſituation, covered and completely protected by the labiæ externæ. When naturally large or increaſed by diſeaſe, or in a very

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* Both Riolin and Morgagni have obſerved the parts without the nymphæ.

relaxed ſtate, they are deprived of this covering: they project from under the labiæ, and are apt to become inflamed, and even to ulcerate. The original diſeaſe, or tumor, is augmented, or they become perhaps hard and callous. In children they bear a very great proportion to the other parts, and are more conſpicuous and prominent than in the adult. Their diſeaſed enlargement ſometimes requires to be extirpated, in which operation, as they are very vaſcular, and as with their growth, their blood-veſſels enlarge, conſiderable hæmorrhagy may be expected. A ſurgeon of this city, in extirpating a tumor of this kind from a young lady, thought his duty fulfilled when he had applied a piece of lint upon the ſurface after the operation, ſo that he even neglected to appoint an attendant. The hæmorrhagy returned, and continued ſo profuſe that before the ſurgeon arrived the lady had fainted.

THE CLITORIS is ſimilar to the male penis. Like the penis, it conſiſts of cells for receiving blood, and in a ſimilar manner, it ariſes from, or takes hold of the rami of the os pubis by two crura;—theſe unite at the ſymphyſis pubis, to form the body of the clitoris, which is ſuſpended from the os pubis, like the penis, by a kind of ligament. The clitoris has alſo a kind of glans, over which the integuments make a fold like a preputium. In ſhort, it has the ſame ſenſibilities, the ſame power of erection with the membrum virile; only it has no urethra nor ſpongy body, like that of the urethra of man.

The ſtories of the increaſe of this inſtrument, even to its preeminence in ſize over the male penis, are very idle, but there ſeems to be a peculiar predilection for them. It is not wonderful that a clitoris of ſuch magnitude ſhould ſuggeſt the idea of a hermaphrodite, or perſon partaking equally of the diſtinguiſhing attributes of either ſex.

OF THE URETHRA.

The urethra of the female is ſhort, ſtreight, and wide; its length an inch and a half, or two inches; its direction nearly ſtreight, or only ſlightly bending under the os pubis; and its diameter ſuch as will admit a catheter the ſize of a writing quill. The conſequences of theſe peculiarities are, that the catheter is eaſily paſſed when there is no very unuſual obſtruction; that women are not ſo much expoſed to the diſeaſe of ſtone in the bladder as men, for though this is much owing to conſtitutional peculiarities, yet it is obvious, that when a ſmall ſtone is formed, and paſſes from the bladder, it is eaſily diſcharged; and, laſtly, that lithotomy is a very ſimple operation in woman.

The opening of the urethra is in a direct line under, or behind the clitoris, and about an inch from it: It is in the middle of a ſlight prominence, and its vicinity is plentifully ſupplied with mucous glands. If the relation of the orifice to the clitoris be obſerved, there is, in the natural ſtate of the parts, no difficulty in ſliping the point of the catheter, on the end of the middle finger, from the clitoris, until it is catched upon the lacuna-like orifice of the urethra; but even in this part of the operation, I have experienced great embaraſſment, from an irregular ulcerated or cancerous ſurface of the parts, by which all the uſual diſtinctions were loſt.

From the length and ſudden turns of the male urethra, from the double function it performs, and from its being embraced by the proſtate gland, the obſtructions of the urine are more frequent, and the catheter leſs eaſily paſſed, than in woman. The catheter too requires to be of a very peculiar form. The ſhort and wide urethra of woman requires only a ſimple and almoſt ſtreight tube: and although, accurately to adapt it to the courſe of the urethra, a conſiderable curve might be given to it, yet that is not neceſſary in common caſes; and circumſtances will occur to the accoucheur which will preclude the poſſibility of uſing ſuch an inſtrument.

We ſhall only mention here ſuch caſes of obſtruction of urine as are in a particular manner illuſtrated by the anatomy and connection of the parts. Theſe are tumors of the ovarium, tumors of the womb, polypi, diſtenſion of the vagina, diſplacement of the womb, as procedentia, prolapſus, retroverſio, &c.; and laſtly, the child's head in labour.

The ovarium being enlarged, and falling down into the pelvis, either preſſes upon the neck of the bladder, cauſing obſtructions, or preſſing and weighing on the fundus of the bladder, it occaſions a ſtillicidium urinæ.

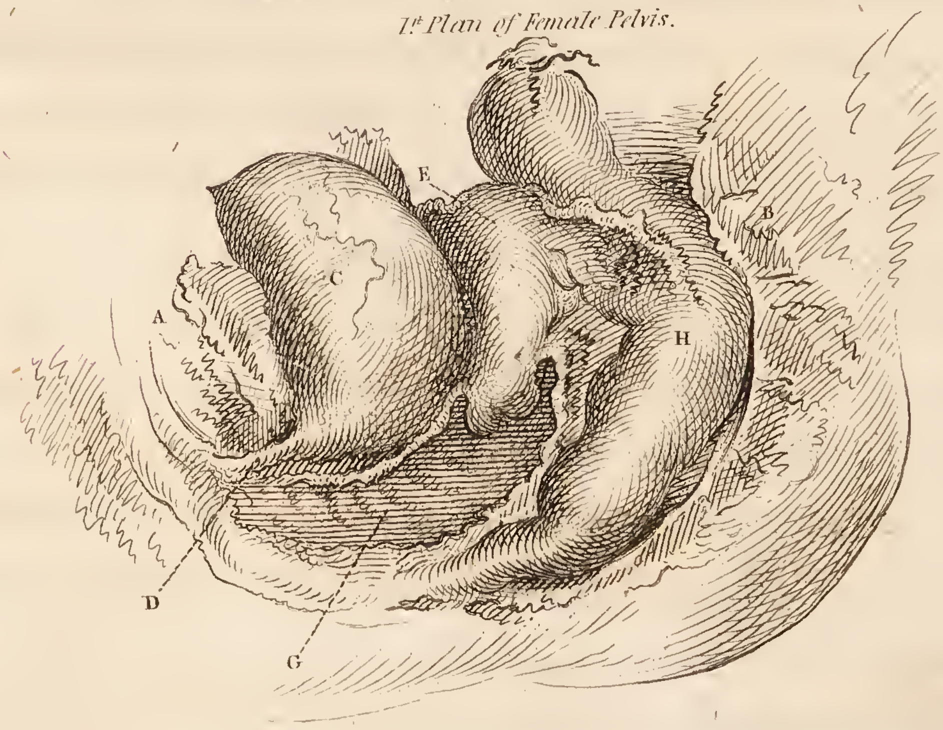
Tumors of the womb, eſpecially of the neck or orifice, as it is in contact with the urethra, very ſoon affect this organ. Thus, I have ſeen a cancer of the orifice of the womb, by exciting inflammation in all the ſurrounding parts, and by maſſing them together into a tumor filling the pelvis, occaſion obſtinate obſtruction of urine.

Polypi attached to the orifice of the womb, and filling the vagina, produce the ſame effect. In all ſuch caſes, perhaps, the tumor may be puſhed up, ſo as to permit the flow of urine, or the introduction of the catheter.

A caſe occurred to Mr. John Bell, in which the tumor of the womb compreſſed the neck of the bladder. A catheter was paſſed, and gave inſtant relief. The midwife, after ſome time came, and ſaid, that the catheter would not paſs. He found that he could paſs the catheter into the bladder, but no urine flowed; and it was diſcovered, that the tumor increaſing backward, came to preſs upon the ureters, ſo as completely to obſtruct them where they enter the bladder. The woman unavoidably died; each kidney and ureter was found to contain four or five ounces of urine.

A ſlight ſketch of the parts in the female pelvis will, perhaps, better explain the connections of the neck of the bladder than any deſcription, and will certainly better illuſtrate the cauſe of ſome kinds of obſtruction, particularly that ariſing from the change in the poſture of the womb.

Firſt Plan of the Female Pelvis.



A, the os pubis cut through.—B, the ſpine and ſacrum alſo cut directly down.—C, the urinary bladder moderately diſtended, and riſing behind the pubis.—D, the urethra, very ſhort, and taking a gentle curve under the ſymphyſis of the os pubis.—E, the fundus of the womb.—F, the os tincæ, or orifice of the womb.—G, the vagina.—H, the rectum.

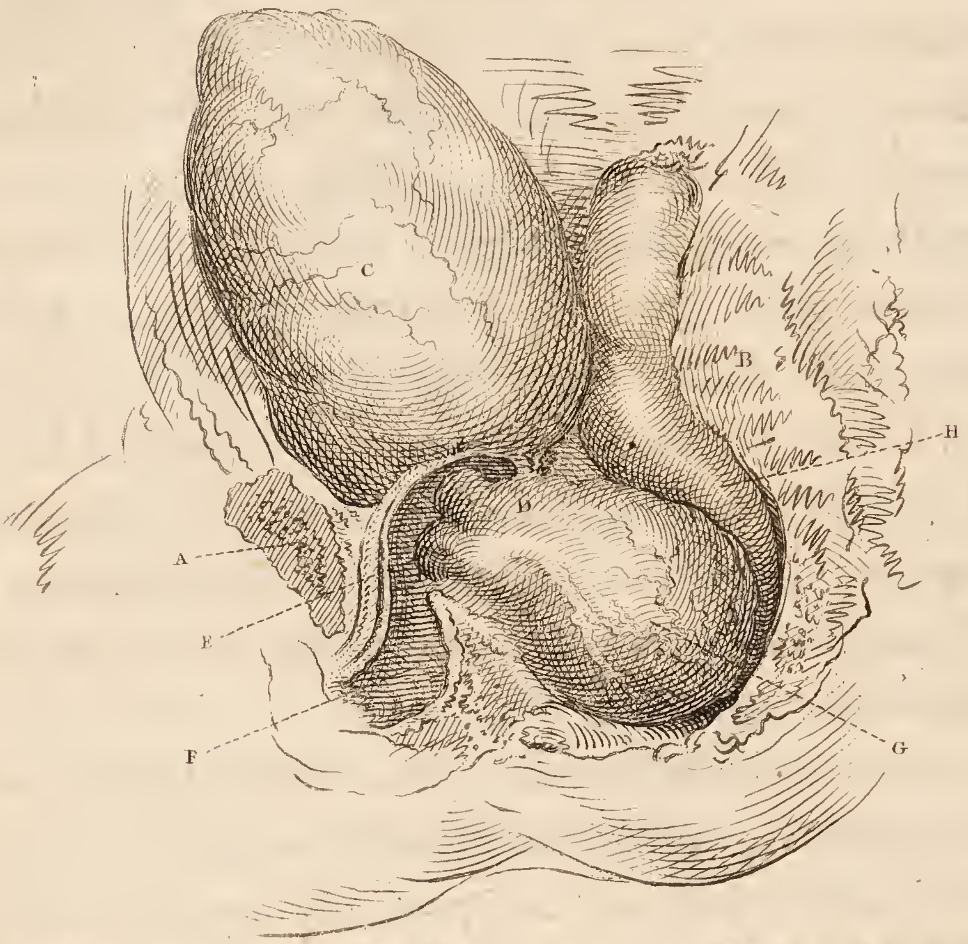
Prolapſus, or falling down of the womb, is frequent with thoſe who have born many children. By this ſlipping down of the body of the womb F, into the vagina G. it preſſes on the neck of the bladder, or urethra. This is alſo apt to happen in the firſt months of pregnancy, from a degree of difficulty which the womb in its enlargement has in riſing above the brim of the pelvis.

We may obſerve alſo from the place of the vagina G, that its diſeaſes, its ſcirrhous hardening, its diſtention by the menſes, will alſo compreſs the urethra and neck of the bladder.

The retroverſion of the womb is the moſt formidable obſtruction to the urethra. It is produced by diſtention of the bladder acting on the womb in a particular ſituation, and is the cauſe of ſuppreſſion of the urine. When the womb in the third or fourth month of geſtation has increaſed ſo much as to produce a degree of compreſſion on the ſurrounding parts, and to riſe above the brim, and ſhoot up into the abdomen, a diſtention of the bladder is apt to throw the fundus under the projection of the ſacrum. We have to obſerve the connection betwixt the back and lower part of the vagina. By the diſtention of the bladder, the vagina is ſtretched, and the orifice of the womb is raiſed, which throws back the fundus of the womb, ſo that this comes to be the ſituation of the parts.

Second Plan of the Female Pelvis.

2d Plan of the Female Pelvis.



A, the os pubis; B, the ſacrum; C, the bladder of urine much diſtended, and riſing above the pubis; D, the connection betwixt the back part of the bladder and the upper part of the vagina, and through which the riſing of this part of the bladder (in conſequence of its diſtention) has drawn up the orifice of the womb, and thrown back the fundus. E, the orifice of the womb, which being raiſed and turned up, no longer preſents ſo as to be felt by the finger in the vagina. It will be obſerved alſo, that the womb now lying acroſs the pelvis, this lower part is forced against the neck of the urethra, ſo as to compreſs it, and cauſe total obſtruction of urine. F, the vagina, which is ſtretched in conſequence of the riſing and turning up of the orifice of the womb. G, the fundus of the womb enlarged and diſtended by impregnation, fallen back under the promontory of the ſacrum, and compreſſing the rectum H.

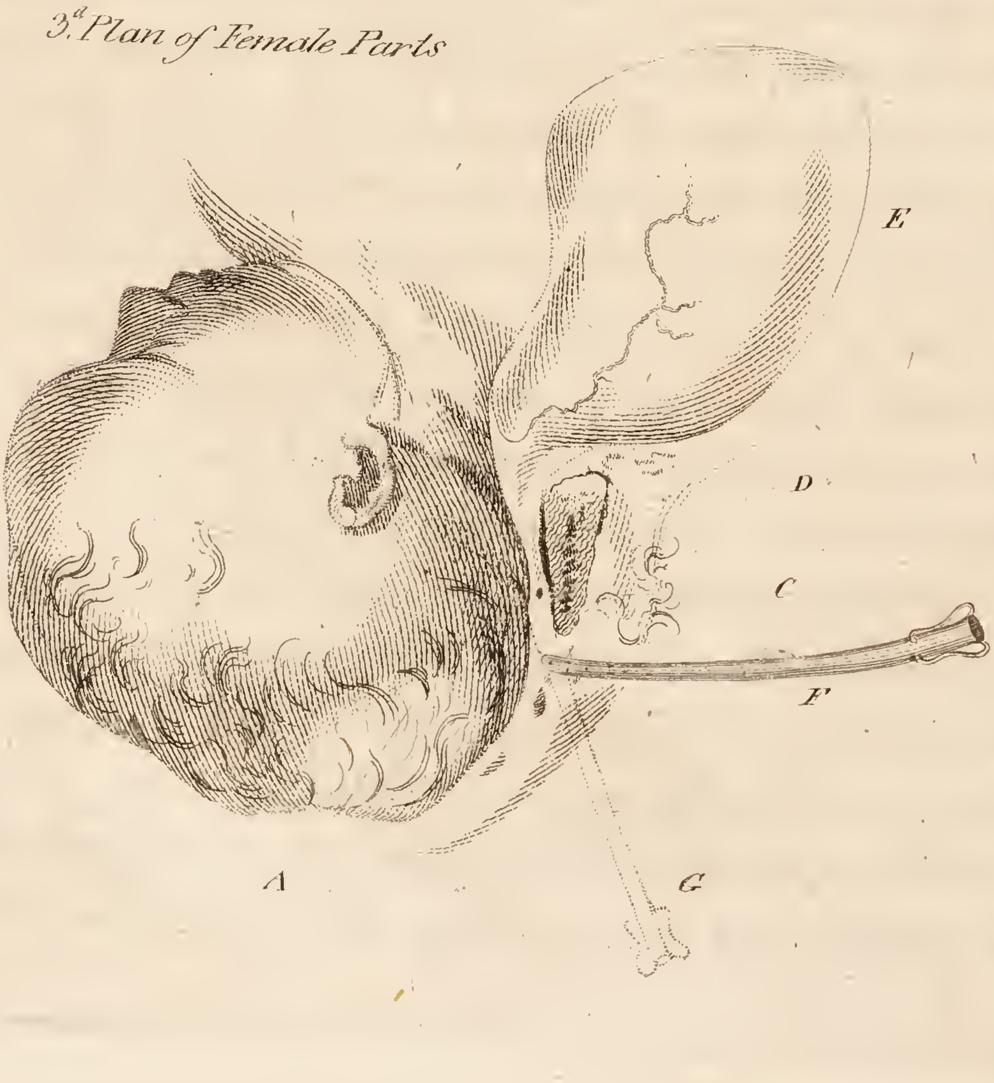
Now, when the fundus of the womb is thruſt back, and the orifice raiſed by the diſtention and conſequent riſing of the bladder, the natural and ſimple cure is to introduce the catheter, and draw off the urine. But should this not be done at firſt, then there being diſtention of the bladder, and preſſure on the rectum, the abdominal muſcles ſympathize with theſe parts, ſo that bearing-down efforts are made, and the fundus of the womb is forced further down into the hollow of the ſacrum, while the orifice is directed upward.

Were this diſtention to happen at any other time than juſt when the uterus is of ſuch a ſize, that being thrown back, it catches under the ſacrum, and does not riſe again, no harm could follow.—I laſt year attended, with Mr. Cheyne ſenior, a woman afflicted with obſtruction of urine, who died. I afterwards opened the body, where the womb being enlarged by diſeaſe, had produced much the ſame effect as if it had been enlarged by pregnancy, viz. obſtruction of the urethra; for the body of the womb had fallen into the hollow of the ſacrum, and had formed adheſions there with the rectum, while the orifice of the womb preſſed forward upon the os pubis, ſo as to produce an obſtruction of urine. The parts were otherwiſe diſeaſed, but this was one cauſe of the obſtinacy and fatal determination of the complaint.

As we treat of thoſe ſubjects only as connected with the urethra, we may obſerve, that ſometimes the urethra takes a courſe not round behind the os pubis ſimply, nor ſtraight upwards, but curved backwards, ſo that the convexity of the catheter requires to be towards the ſacrum, to allow the point to paſs over the orifice of the womb, or perhaps the flexible, or the male catheter may be required.

The effect of the wedging of the child's head in a tedious labour, is to elongate and compreſs the urethra in a very particular manner. Many young men have felt the difficulty of introducing the catheter in this caſe. But it is a difficulty proceeding generally from ignorance, or inattention. I have never ſeen a caſe in which the compreſſion was ſo great as to prevent the paſſing of the catheter. But often practitioners forget the direction which the urethra neceſſarily takes, when the child's head has ſunk into the pelvis.

Third Plan of the Female Parts.



Thus, when in the ſecond ſtage of the labour, the child's head A, has ſunk into the pelvis, the urethra C, is preſſed betwixt it and the os pubis D. The urine conſequently collects in the bladder, and the bladder E, riſes above the brim of the pelvis, and I have found it ſtretching to the ſcorbiculus cordis. There is danger from the diſtention of the bladder, and the labour-pains ceaſe. Now the young ſurgeon or accoucheur, introduces the catheter in the uſual way, in the poſition F, of courſe he finds great difficulty, and gives pain in the attempts. But after inſerting the point of the catheter, he muſt incline its handle much towards the perineum, as in the inclinations of the dotted lines G, ſo that the point may glide up in the direction betwixt the child's head and the pelvis.

ORIFICIUM VAGINÆ. This is alſo named ORIFICIUM EXTERNUM, in oppoſition to the uterine orifice. I notice it under the head of the external parts, becauſe we have to ſpeak of the parts which ſurround the orifice as the hymen.

The orifice of the vagina of the human female is abridged by the hymen, which is a peculiar membrane. It is of a ſemilunar form, and ſometimes ſurrounds the lower part of the orifice of the vagina ;—commonly it ſurrounds only the lower half of the circle, though it would ſeem to vary conſiderably in ſhape, place, and ſtrength. It has been found ſurrounding the whole circle of the orifice, leaving only a ſmall hole in the centre, or upper part; or it is deſcribed as perforated with leſſer holes, allowing the evacuation of the menſtrual blood. In other caſes, it has been found a complete circle, preventing the evacuation of the menſtrual blood.—This is a fact which I do not diſpute, for I know that the perforation for the evacuation of the menſtrual blood is ſometimes neceſſary. When I have ſeen the imperforated vagina in the child, it was not the hymen which cloſed the orifice, but an adheſion of its ſides; yet this adheſion, if it had come to be diſtended with the menſtrual blood of ſeveral periods, would have preſented the appearance of a tenſe membrane ſtretched acroſs the orifice.

Such a membrane as I have deſcribed, will occaſionally be ſeen in the female parts; but it has ſuch an appearance as may eaſily be deſtroyed in the preparation of the parts, if the anatomiſt be inattentive or careleſs. It is neither a guard, nor is its exiſtence a teſt of female chaſtity. Often in tender children there is no ſuch thing to be ſeen; while, on the other hand, it has been cut to admit of labour and delivery *. Either of theſe facts is ſufficient proof of the idle notions entertained concerning this membrane. It has been a favourite topic in all ages, and in all ſituations. The ſavage, and the gentleman, make much the ſame enquiries on viſiting a muſeum; and ſuch was the ſubject of Omai's ſpeculations in the muſeum of Dr. Hunter.

THE CARUNCULÆ MYRTEFORMES—are ſmall and irregular tumors at the back, or lower part of the external orifice; they are ſeated rather at the ſides than exactly

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* I need not ſay how unneceſſary and improper ſuch operations are. All rigidity, caloſities, even tumors, and undoubtedly the hymen, will yield to that general relaxation of all the parts, which takes place upon the commencement of labour.

exactly at the back part; they are generally ſuppoſed to be the ruins of the hymen, which being lacerated, ſhrink into two or three tumors on each ſide. Some have ſaid, that theſe exiſt originally joined together by a thin membrane, or delicate tiſſue of ſmall veſſels, the rupture of which cauſes an effuſion of blood. They ſeem to be ſimply corrugations of the inner membrane, which ſerve as a proviſion for the dilatation of the parts; and they accordingly diſappear during the paſſing of the child's head.

The fossa navicularis is a ſinus, ſuppoſed to be of the ſhape of a boat, whence its name. It is formed betwixt the proper orifice of the vagina and the fourchette, or joining of the labiæ at their lower edge. It is more conſpicuous in young ſubjects.

From the meeting of the labiæ below, the Perineum commences: it includes that ſpace from the frenum to the anus.

CHAP. II.

OF THE PARTS CONTAINED WITHIN THE FEMALE PELVIS.

THESE parts are the bladder of urine, the vagina, the womb, the ovaria. We ſhall conſider them under diſtinct ſections.

SECTION I.

OF THE BLADDER OF URINE.

As the coats of the bladder of urine in woman do not vary from thoſe of the male bladder, we have under this head only to notice the peculiarities in its relative ſituation. It is ſeated behind the os pubis, and betwixt it and the womb; and on its lower part it is attached to the vagina; upon the neck of the bladder, or the beginning of the urethra, there is not a body like the proſtate gland; and, as we have ſeen, the urethra is ſhort, wide, and ſtraight, and ſimple in its uſe.

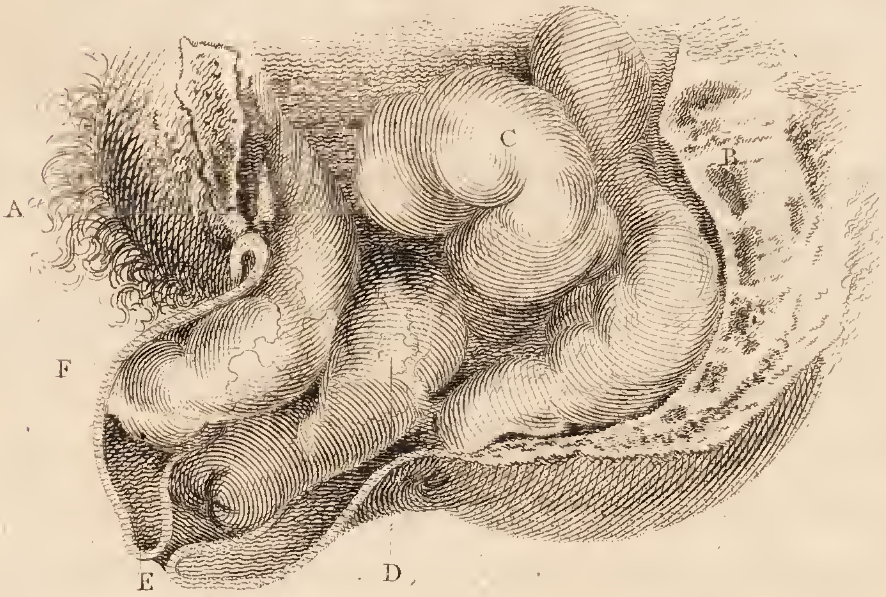
Women are not ſubject to calculi, and the operation for the ſtone is rare in them; for, as already obſerved, when the nucleus is formed, or when a ſtone ſlips down from the pelvis of the kidney, it paſſes from the bladder with much greater facility than in the male parts. The urethra of itſelf has been known to dilate ſo, as to allow very large ſtones to paſs, or it has been artificially dilated. Indeed the old operation for lithotomy, was rudely to dilate, or rather tear, the urethra, and the modern operation is ſimply to thruſt the gorget along the grooved ſtaff, ſo as to lay open the ſide of the urethra and neck of the bladder, by an inciſion above the vagina. Sometimes nature has effected her own relief by the ſtone working from the neck of the bladder into the vagina.

A woman had for a very long period ſuffered great diſtreſs, not only the ardor urinæ, frequent deſire to make urine, with the urine turbid and bloody, and with all the uſual ſymptoms of ſtone violently aggravated; but ſhe was delicate and timorous, and concealed her diſtreſs until the urine had run for ſome time by the vagina. After ſhe had been exhauſted by long ſuffering, her friends inſiſted that ſhe ſhould allow an examination, when a ſtone was found partly in the bladder, with one of the rough ends projecting into the vagina. The opening was enlarged, and the ſtone extracted.

We muſt, in all caſes, recollect the connection of the upper part of the vagina and orifice of the womb, with the back part of the bladder. We have ſeen its effect in producing retroverſio uteri. We muſt alſo attend to this connection, as tending to the diſplacement of the bladder in the procedentia uteri. The uterus ſinking into the vagina, and the upper part of the vagina being at the ſame time reflected into the lower part, pulls down the bladder with it, and when (the diſeaſe increaſing) the womb covered by the vagina comes to hang from the external parts, it has happened that the bladder has ſunk down and lain upon the fore-part of the tumor, but of courſe within the everted vagina.

4th Plan

Section ſhewing the effect of Procedentia on ye Bladder:



Thus, by comparing this fourth plan with the firſt of the female pelvis, we may judge of the nature of this diſplacement of the womb, and its effects on the bladder of urine.

A, the os pubis; B, the ſacrum; C, the inteſtines come into the ſituation of the womb; D, the uterus fallen down, and carrying the vagina before it; E, the vagina ſtill covering the womb, but the orifice of the womb appearing, which is generally diſtorted and irregular; F, the bladder, which, from its attachment to the fore-part of the vagina, has been dragged down, but is now within the vagina.

In ſuch diſplacement of the bladder, the urethra becomes diſtorted from its natural direction, there is an obſtruction of urine, and the catheter is with great difficulty introduced. We ſhall, perhaps, have to turn the handle of the catheter in various directions after introducing the point, and by chance get it introduced at laſt.

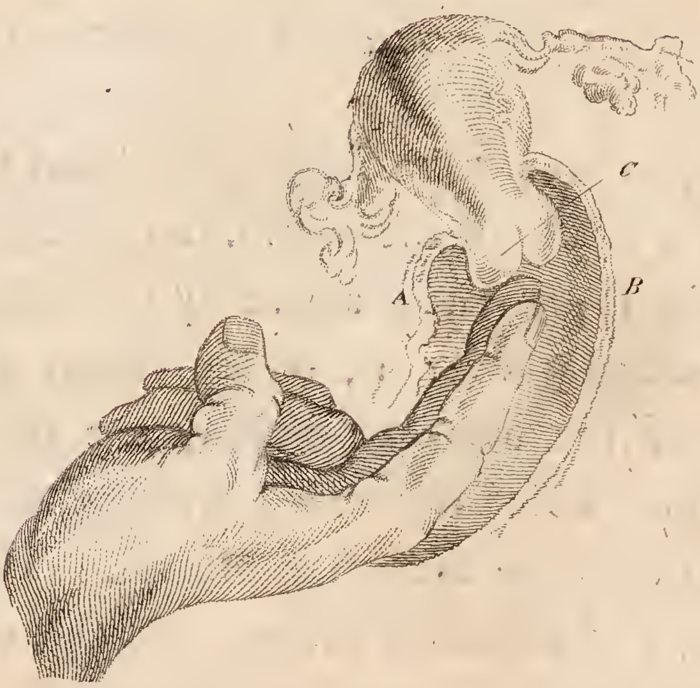
SECT. II.

OF THE VAGINA; OF ITS SHAPE, CONNECTIONS, ETC.

THE vagina is a tube ſtretching from the external orifice to the orifice of the womb. Its orifice is bounded below by the fourchette; above by the arch of the pubis; and directly over it, or ſometimes within it, is the orifice of the urethra; below, are the carunculæ myrtiformes. It is ſurrounded by faſciculi of fibres, which are called the ſphincter muſcle. The canal of the vagina is of a conical form. At the outer orifice it is conſtricted by the ſphincter muſcle; but it is wider within, and where it receives the orifice of the womb. It may be diſtended to almoſt any degree, but naturally its ſides, by their own elaſticity, or the contraction of the ſurrounding fibres, or the preſſure of the ſurrounding parts, are in contact.

In the natural ſtate, the orifices of the vagina and womb, are but three or four inches diſtant, often only two; and ſometimes, where there is a degree of relaxation, they are nearly in contact. In the firſt months of pregnancy, the orifice of the womb is kept down by the degree of difficulty the body of the womb has in ſhooting up from the brim of the pelvis. But the gravid uterus riſing above the pelvis in the latter months, draws up the orifice of the womb, and ſtretches the vagina.

The vagina bends gently round the pubis as it were, or follows the axis of the pelvis; and as the interior of two circles cut off by the ſame radii is the ſhorter, the vagina is longer behind than before.



And thus (*in this fifth plan*) the fore-part of the vagina A, is ſhorter than the back part B. We may obſerve from this plan alſo, that the orifice of the womb C, projects as it were into the vagina, ſo that the finger touches the os tincæ, and chiefly its anterior lip, without reaching the upper part of the vagina.

The vagina takes its curve nearly in the centre of the pelvis; it is of neceſſity attached by cellular ſubſtance to the rectum and bladder. The urethra, as we have ſaid, opens above the orifice, and that canal is attached to the vagina in its whole length; and the neck of the bladder is attached to the upper part. In conſequence of this natural connection, diſeaſe of the vagina ſometimes throws the whole parts, the rectum, vagina, and bladder, into one fiſtulous ulcer.

The vagina has three coats; that is to ſay, it has the inner coat, or ſurface, a few muſcular fibres, and around it a condenſation of the ſurrounding cellular membrane, which may be conſidered as the third coat.

The internal, or villous coat, is a reflexure of the delicate covering of the external parts. It is of larger extent, or longer than the others; and is therefore tucked up into rugæ, which run acroſs the vagina. They are more remarkable on the fore and back part of the vagina; they are leſs in married women, and conſiderably obliterated by repeated labours.

To ſupply a viſcous ſecretion for the defence of this ſurface, mucous glands are numerouſly, but irregularly ſcattered over it, and they are particularly numerous at the orifice.

The muſcular coat is not very ſtrong, nor are the fibres diſtinct, from which ſome have ſuſpected their exiſtence, alleging, that there is here only condenſed cellular membrane, and that the contraction of the vagina is the effect of mere elaſticity. I obſerve ſo great a profuſion of venous vaſcularity, that I preſume the vagina ſuffers an inflation of its coats, and conſequently contraction from an afflux of blood to it. The muſcular fibres are, however, as we have ſaid, gathered into faſciculi near the orifice, ſo as to be diſtinctly viſible.

The firmneſs and ſtricture of the vagina ſupport the womb; the dilatation of the vagina, the relaxation which old age, and frequent labours produce, occaſion the falling down of the womb. It is a diſeaſe almoſt peculiar to thoſe who have borne many children, to the old, weak, and relaxed, and to thoſe who are ſubject to the fluor albus; every flux from the womb, or diſcharge from the vagina, having a remarkable effect in relaxing the parts.

This, from the nature of the parts, muſt be an increaſing diſeaſe; for no ſooner has the womb fallen down into the vagina, than it becomes a ſource of irritation, excites a bearing-down pain-like teneſmus, an uneaſy ſenſation, a deſire to make urine, and an obſtruction of urine; all which is explained by the connection of the parts. The womb lodging in the vagina dilates the orifice, and preſſes long on the perineum, at laſt it is entirely forced out, and the prolapſus uteri becomes the procedentia uteri: it is in truth a hernia of the womb.

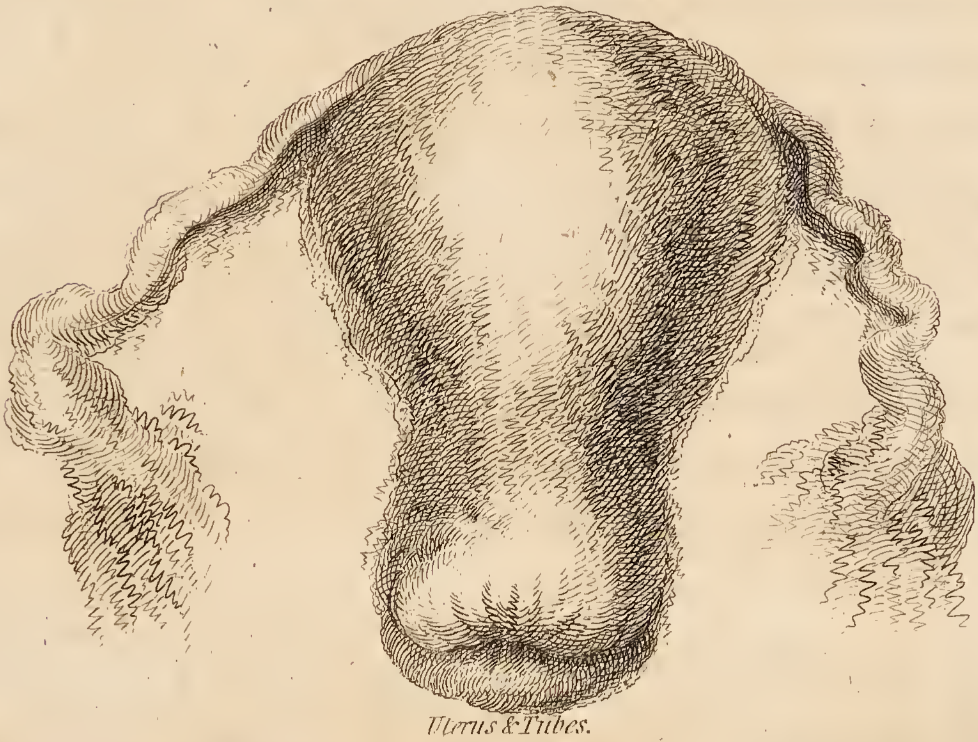
The third, and outer coat, as we have ſaid, is formed of the cellular membrane, by which it is connected with the ſurrounding parts; but the peritoneum comes down upon the upper part of the vagina. This is the reaſon why a portion of the inteſtine, when it ſlips down betwixt the vagina and rectum, forms a kind of hernial tumor in the vagina, and why the water of aſcites has puſhed down the back of the vagina, ſo as to make a bag capable of being punctured to draw off the water.

For the greater ſpace, however, the outer cellular coat of the vagina connects it with the urethra on the fore-part, and with the rectum behind. From which cloſe connection of parts, we ſee the conſequence of the delay of the child's head in the ſecond ſtage of labour, that the head lies violently diſtending, and compreſſing the parts, while the woman, exhauſted by the previous ſtage, is unable to complete the delivery. From violent inflammation, with a deficency of ſecretion, there ariſes a cold and flabby ſtate of the parts. When the woman is delivered, the parts have ſuffered ſo much, that they ſlough off; ſometimes the urethra is laid open on the fore-part, and ſometimes the rectum behind.

SECTION III.

OF THE WOMB.

6th Plan of ye Fe Parts.



Uterus & Tubes.

THIS little drawing will better explain the figure of the womb, when diſſected from the vagina and ſurrounding membranes, than the uſual neceſſary reference to a bottle, a pear, or a powder-flaſk. As, indeed, it ſtrictly reſembles no familiar object that I know, we muſt, for the convenience of deſcription, diſtinguiſh it into theſe parts:—The upper part, or FUNDUS, which is that part above the going off of the Falopian tubes. The BODY of the uterus, which is that larger part betwixt the fundus and the narrowing below; THE CERVEX, which is the narrow neck; and the os TINCÆ, or orifice formed of the bulging lips, which project into the vagina, of courſe that part over which the inner membrane of the vagina is reflected. We diſtinguiſh alſo the two ſurfaces, for the womb is of a flattened form. The anterior ſurface of the body of the womb is convex, but the poſterior ſurface is conſiderably more ſo, and even during geſtation it keeps this relative figure.

The whole ſize of the uterus is about three inches in length, and two in breadth, but there is a very great variety in this reſpect, from age, the effect of pregnancies, and other cauſes. When, in its uſual ſituation and relations, the fundus is on a level with the brim of the pelvis, or a very little below it. In the fœtus, the womb is like the bladder, conſiderably above the brim of the pelvis; but, in a few weeks the pelvis enlarging, it ſinks deeper, and ſoon aſſumes the ſame ſituation as in the adult.

FALOPEAN TUBES. From the lateral obtuſe angles formed betwixt the fundus and the body of the uterus, the Falopean tubes are continued. Theſe tubes may almoſt be conſidered as a continuation of the uterus, did not we find them ſo very diſtinct in their ſubſtance. They are about three inches in length, take a tortuous courſe, and their extremities have an unequal fringed termination, which is called the FIMBRIÆ *. Their canal is very ſmall towards the uterus, but enlarges, and is patulous towards the extremities. Theſe canals are the communications by which the ovum formed in the ovarium is carried down into the womb.

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* *Morſus diaboli.*

LIGAMENTS OF THE UTERUS. To ſupport the uterus from ſinking too deep into the pelvis, and to ſteady it, and direct it in its aſcent during pregnancy, anatomiſts have generally aſſigned as the uſe of the ligaments. But whatever good they may do in the latter operation, they are certainly unfit for the former.

There are four ligaments of the uterus.

The BROAD LIGAMENT of the uterus is formed of the peritoneum; for this membrane paſſing down before the rectum, and aſcending again, and covering the neck, body, and fundus of the womb, deſcends on the fore-part, ſo as to reach the vagina before it riſes over the bladder. Thus it inveſts the womb as it does the abdominal viſcera. This inveſting of the womb with the peritoneum is indeed a proviſion for its becoming an abdominal viſcus, for in pregnancy it riſes out of the pelvis; and, being diſtended before the bowels, aſſumes in every reſpect that relation to the peritoneum which they have.

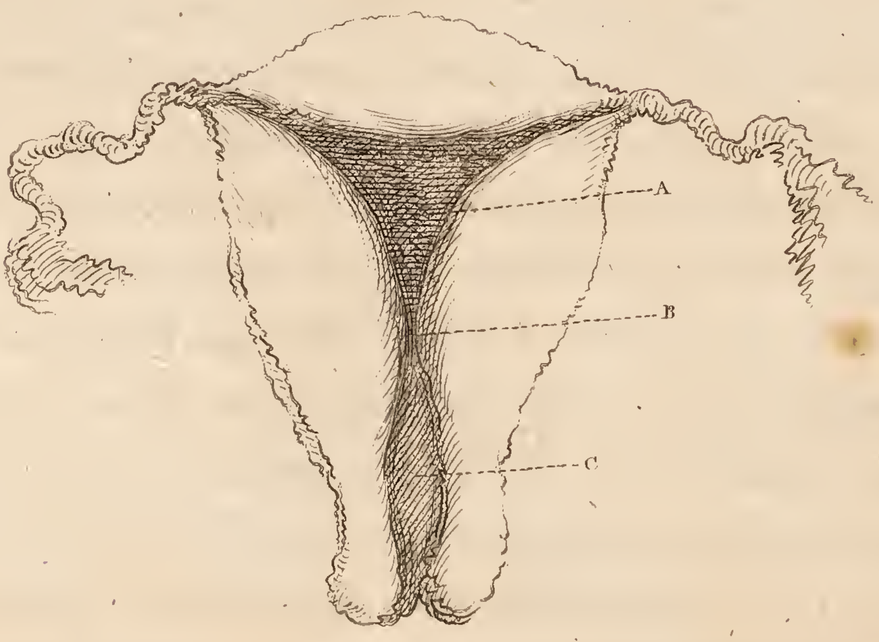
As the womb then is included betwixt the duplicature of the peritoneum, it is this peritoneal coat, which being continued off laterally, forms the broad ligament of the womb. This duplicature of the peritoneum being a thin expanſion of it, has ſometimes had the name of ALÆ VISPERTILIONIS: It is in truth like a myſentery to the womb and Falopean tubes, and ſerves equally to ſupport and convey the veſſels to them. The womb and the two ligaments make a complete partition running acroſs the pelvis.

From the ſide of the uterus, a little below, and before the going off of the Falopean tubes, the ROUND LIGAMENTS ariſe. I conſider theſe ropes as ligaments,

ments, but they are totally unlike any common ligament. They ſeem intended to give the due inclination forward, and to direct the uterus in its aſcent in pregnancy, and accordingly they are not merely condenſed and unelaſtic cellular membrane; but, on the contrary, they are compoſed of fibres, with an intermixture of blood-veſſels, ſo that whilſt they keep a degree of tenſion on the uterus, they yield and grow not only in length, but in thickneſs and ſtrength, as the uterus aſcends in the advanced pregnancy: they paſs through the abdominal ring, and are attached to the cellular membrane of the top of the thigh. In the gravid uterus, both the broad and the round ligaments conſiderably alter their poſition, appearing to riſe lower, and more forward from the womb than in the unimpregnated ſtate. This is in conſequence of the greater increaſe of the fundus of the womb, in proportion to the lower part of it.

OF THE CAVITY OF THE UTERUS.

6th Plan.



The cavity of the uterus is properly confined to the fundus and body, and takes a triangular figure. In the cervex, it is more like a canal, and differs eſſentially from the proper cavity. A, *the cavity of the uterus;* B, *the continued cavity,* where it is very narrow towards the cervex. C, *the canal of the cervex,* where it has an enlargement like a ſinus. The Falopean tubes going off from the cavity of the uterus. Theſe angles of the cavity admit no more than a hog's briſtle. The third angle, towards the neck, is, of courſe, conſiderably larger. The proper triangular cavity of the uterus is lined with a peculiar ſoft and delicate membrane; it is very vaſcular, and the veſſels either open on the ſurface naturally, or burſting out from time to time, pour out the menſtrual blood. The canal of the cervex ſhows a very different ſurface. We obſerve a prominent longitudinal line on the fore and back part of it, from which oblique and tranſverſe rugæ go out. The ſurface is firmer and callous, and leſs vaſcular. Betwixt the rugæ there are lacunæ, which throw out a mucilaginous fluid; and towards the orifice we ſee theſe larger, and ſometimes diſtinct glandular bodies.

This peculiar ſhape of the cavity of the womb, and the hardneſs and ſmall degree of vaſcularity of the lower part, is of the moſt eſſential importance. The upper part, the proper cavity of the womb, is prepared for the reception and immediate adheſion of the ovum, when it ſhall have deſcended through the Falopean tube; but the long callous cervex is provided, that there may be no adheſion to the lower part of the womb, and that the placenta may not form over the orifice of the womb, for if it ſhould, the moſt dangerous kind of flooding takes place on the approach of labour from the opening of the orifice, and the tearing open of the adheſions of the placenta, before the child can be delivered. The length of the cervex, and the glandular ſtructure of the orifice is alſo of much importance in ſealing up the cavity of the womb after conception, that there may be no longer communication with the vagina; for this purpoſe, a viſcid tenacious mucus is poured out; but, on the approach of labour, with the ſoftening and relaxation of all the ſoft parts, this adheſion and gluing up of the orifice is diſſolved, and a more fluid ſecretion is poured out.

From the cavity of the womb the MENSTRUAL BLOOD is diſcharged at certain periods, from the time of puberty to the approach of old age, when the ſyſtem is no longer capable of giving nouriſhment to the fœtus. We ſhall preſently find, that the ſubſerviency of menſtruation merely to the preparation of the ſurface of the womb for the reception of the fœtus, though it be a principal, is by no means the ſole end of this periodical diſcharge.

It was long diſputed from what ſource the menſtrual diſcharge flowed. Some affirmed, that it muſt flow from the vagina, and not from the womb, becauſe it flowed ſometimes during geſtation. This is a fact which cannot be denied. I have attended a patient who menſtruated during the entire period, or to the eighth month; and I have often obſerved ladies to menſtruate at the firſt period after conception. On the other hand, we have every proof of the diſcharge being from the orifice of the womb. For inſtance, ſome have obſerved on diſſection of the parts of women dying during the flow of menſes, that blood was effuſed under the delicate membrane of the cavity of the womb. The veſſels there have been obſerved particularly turgid, or the whole ſurface of the proper cavity, and eſpecially the fundus, ſpotted with bloody effuſions. More particular obſervation has ſhewn, not only the mark of blood poured out from the inner ſurface, but that the whole ſubſtance of the womb was become thick, ſoft, and vaſcular *; and M. Littre affirms, that in the body of a woman who had died during menſtruation, and with a conception in the Falopean tube, he found a layer of red coagulated blood; upon removing which, he ſaw a number of ſmall foramina which admitted briſtles †.

But the beſt and leaſt equivocal proof is, that which has been repeatedly obſerved in the inverſion of the womb, when the inner ſurface has been turned out after labour, and has remained thus inverted, and protruding from the external parts, for then the menſtrual blood has been ſeen to diſtil from the ſurface of the cavity of the uterus.

OF THE BLOOD-VESSELS OF THE WOMB.

Theſe are four large arteries which ſupply the ſyſtem of the womb, and four large veins which return the blood.

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* The authorities upon this ſubject are Spigelius, Morgagni, M. Littre, Mouriceaux, Winſlow, Sympſon.

† This might have been an early abortion, or perhaps the decidua which it is ſaid is ſometimes formed at the menſtrual period.

The SPERMATIC ARTERIES come down from the aorta itſelf, or from the renal or capſular arteries. The ſpermatic artery taking a waving direction, becomes tortuous in a moſt remarkable degree as it approaches the uterus, it is diſtributed to the Falopean tube, the ovarium, but chiefly to the body and fundus of the uterus, where it forms remarkable anaſtamoſes with the artery of the other ſide.

The LOWER ARTERY—the UTERINE ARTERY, comes in general from the hypogaſtric artery, takes alſo a ſerpentine courſe, and is diſtributed to the vagina, and the lower part of the uterus, and inoſculates largely with the other veſſels, both in the uterus, and by particular branches on the ſide of the uterus.

In the firſt place, it appears, that this copious ſupply of veſſels to the uterus, from four different ſources, is a proviſion that the womb and ſecundines ſhall not by any accident of poſition, or by the progreſs of labour, and the conſequent compreſſion of one or both the lower veſſels, be deprived of their due ſupply of blood. Again, their tortuous forms give proof of their occaſional greater activity, that they admit of a peculiar and local action during menſtruation, and that the blood will move more languidly when the ſtimulus of the womb has ceaſed. It is alſo a proviſion for the growth and increaſe of the womb, and the ſupply of nouriſhment to the ovum. And that an increaſed activity in a part muſt be ſupplied by a more tortuous form, as well as an enlargement of the calibre of the veſſels, is in a particular manner illuſtrated by the change which takes place in theſe veſſels during pregnancy. For they become in a much more remarkable degree tortuous and enlarged.

The ſubſtance of the uterus is ſaid to be ſpongy and compact, which, though it is a ſeeming contradiction in words, does yet really convey an idea of the effects of its copious intertexture of veſſels. Some have ſaid, (as Moriceau,) that by pregnancy the womb is diſtended, and grows thinner: others, that it grows thicker, as Daventer: and others again, as Smellie, aſſert, that it continues of its natural thickneſs. Theſe aſſertions are none of them perfectly correct: for the womb is not diſtended by the growth or the fœtus and membranes, but grows with them. Again, that the ſubſtance of the womb grows in a remarkable degree, is true, but ſtill when diſtended by the waters in the laſt months of pregnancy, its walls are thinner than in the unimpregnated ſtate. Thus, when it has been cut in the living body, upon the approach of labour, in the Cæſarean ſection, I have obſerved it, not more than a quarter of an inch in thickneſs, even at the part to which the placenta adhered. When I have diſſected the womb after a tedious labour, the waters diſcharged, but the head wedged in the pelvis, I have found it conſiderably thicker. And, laſtly, in the full contraction of the womb, after expelling the fœtus and placenta, (for example, in rupture of the womb, where the child and placenta had been forced amongſt the bowels, and the woman ſoon after died,) I found the walls of the womb about three quarters of an inch in thickneſs.

SECTION IV.

OF THE OVARIA.

THE OVARIA, are two oval bodies, which are ſuſpended in the broad ligament behind, and a little below the Falopean tubes: while they have an oval figure, they are ſomewhat flattened. By cutting out the ovaria, the animal loſes the power of conceiving, and deſire is extinguiſhed; they, therefore, beſtow what is eſſential to generation upon the part of the female. In vague ſpeculations on the ſubject of generation, they were ſuppoſed to prepare a female ſemen! but more particular examination demonſtrates, that they conſiſt of veſſicles, which are ova; but how far incomplete, or in what eſſential circumſtance requiring the approach of the male, is not determined.

When we hold the ſection of the ovarium betwixt the eye and the light, we ſee a great many pellucid veſſicles; and if we examine the ovarium of an animal killed in full health, and particularly in the ſeaſon, we ſhall obſerve theſe ova to be in all varieties of ſtates of preparation for impregnation. Some ſmall and pellucid, and yet only diſcernable in the thick outer coat, by having a degree of greater tranſparency; others, which have taken a ſlight tinge of bloody colour from veſſels ſtriking into them; and if the ſection be made after a minute injection, the veſſicles will be ſeen coloured in the proportion of their maturity; ſome without a ſpeck of colour; others tinged; one or two loaded with injection; and ſome vaſcular, and particularly prominent.

In very young girls, the ſubſtance of the ovarium is whitiſh, and very ſoft; the ſurrounding membrane is thick; and the round corpuſcles ſcarcely diſcernable; and no irregularities, nor any of thoſe bodies called corpora lutea, are to be ſeen on the ſurface. But as the girl advances in years, the little veſſicles begin to appear, and when about ten years of age, or juſt before menſtruation, the ovarium is full of ova of various ſizes, and ſome of them more matured, and forming an eminence upon the ſurface. In the adult woman, the ſubſtance of the ovarium, which appeared as an uniform homogeneous maſs in the fœtus, is become a cellular and vaſcular bed, giving nouriſhment to thoſe numerous veſſels or ova. Before impregnation can take place, there muſt be a certain ſtate of preparation of the ovaria, without which the approach of the male effects no change in the uterine ſyſtem. The lower animals having their ſeaſons, and theſe ſeaſons being a ſtate of preparation for the male, impregnation follows the copulation with much certainty: but, in woman, ſuch a periodical revolution in their ſyſtem, and inſtinctive deſires, would but ill accord with that ſuperiorty in attributes of the mind, which diſtinguiſh us in the ſcale of beings. But women alſo ſuffer ſuch an occaſional excitement in the uterine ſyſtem, though unaccompanied with deſires, which preſerves the womb in a ſtate of preparation for the reception of the ovum, and the ovaria in a ſtate of preparation for impregnation. This is the effect of menſtruation.

OF PUBERTY.

Authors have long, with many expreſſions of ſurprize, laboured to aſſign a cauſe, or frame a theory for the explanation of thoſe changes which we obſerve in woman at the age of puberty: and generally, in their theories, they have connected with theſe changes the monthly and periodical diſcharges of blood from the uterus, which commences with puberty. Theſe theories have been founded in general, on principles remote from the laws of a living ſyſtem. At this period of puberty, the whole frame is expanded into the fulneſs of feminine beauty; the breaſts rapidly increaſe, and are matured; the parts of generation are enlarged; the hair of the pubis grows, and the menſes flow. In explanation of theſe changes, theoritical conjectures after this model have been entertained. "About this time the growth of the body begins conſiderably to diminiſh, and the blood finding eaſy admittance into the completed viſcera is prepared in greater quantity, the appetite being now very ſharp in both ſexes, a plethora conſequently follows. In the male it vents itſelf frequently by the noſe, from the exhaling veſſels of the pituitary membrane being dilated, &c.; and now the ſemen firſt begins to be ſecreted, and the beard to grow. But, in the female, the ſame plethora finds a more eaſy vent downwards, being that way directed, partly by the weight of the blood itſelf to the uterine veſſels, now much enlarged, of a ſoft fleecy fabric, ſeated in a looſe hollow part, with a great deal of cellular fabric interſperſed, which is very yielding and ſucculent, as we obſerve in the womb: for theſe cauſes, the veſſels being eaſily diſtenſible, the blood finds a more eaſy paſſage through the very ſoft fleecy exhaling veſſels which open into the cavity of the uterus, as being there leſs reſiſted than in its return by the veins, or in taking a courſe through any other part; becauſe, in females, we obſerve the arteries of the head are both ſmaller, in proportion, and of a more firm reſiſting texture. The return of the ſame is, therefore, more ſlow, both becauſe the flexures of the arteries, from the increaſed afflux of the blood, become more ſerpentine and fit for retarding the blood's motion *, and likewiſe, becauſe it now returns with difficulty through the veins. The blood is therefore firſt collected in the veſſels of the uterus; next, it is accumulated in the arteries of the loins, and the aorta itſelf, which urging on a new torrent of blood, augments the force ſo far as to diſcharge the red blood into the ſerous veſſels, which at firſt tranſmit an increaſed quantity of warm mucus, afterwards a rediſh coloured ſerum, and by ſuffering a greater diſtenſion, they at laſt emit the red blood itſelf. The ſame greater impulſe of blood determined to the genitals, drives out the hitherto latent hairs, increaſes the bulk of the clitoris, dilates the cavernous plexus of the vagina, and whets the female appetite to venery, &c."

We cannot give implicit truſt to ſuch ſpeculation, we cannot believe in this plethora, produced by the diminiſhed growth of the limbs; neither can we be-

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* I have ſhown that the tortuous arteries always form a proviſion for the occaſional increaſe of the action and acceleration of the blood.

lieve that congeſtion and plenitude is produced in the female ſyſtem, from the deficiency of perſpiration, from their more lax and weaker ſolids compared with man, from their indolent and ſedentary life: for facts are in direct contradiction. The growth and completed function of parts at this particular age, is not to be explained by any theory ſo partially applicable; during almoſt every period of life, there are ſimilar changes taking place in ſome one part of the body. Parts lie dormant, and are ſtationary in their growth, which at a particular and ſtated age of the animal, enlarge and develope themſelves by a new and invigorated action. Obſerve how different the proportions of the fœtus are from thoſe of the adult. We ſee nature careful to perfect certain parts, as the head and liver, at an early period. We ſee during early childhood how the parts ſhoot out, and evolve in due proportion. We ſee parts which were large in the fœtus loſe their preponderance: we ſee others, which ſerved ſome purpoſe in the fœtal ſyſtem, gradually ſhrink and diſappear, becauſe they have no longer the ſtimulus to action in the circle of connections which take place in the adult ſyſtem. We find other parts, as the teeth, for example, lying long within the jaw, inſtead of proceeding with a gradual and continual enlargement, ſuddenly riſing at certain ſtated periods from their embryo ſtate, and enlarging and puſhing up through the gums, when it becomes fit that the child ſhould take more ſolid food than the mother's milk. So the ſecond ſet of teeth, in a more particular manner, lie quite ſtationary in their growth within their little ſacs, yet quickly, at ſtated periods, they increaſe, the enamel is formed, and they riſe above the gum. There is an infinite number of ſuch changes depending upon the ſame laws of the œconomy, and not different from thoſe which controul the growth, and direct the ſhape of parts. They depend upon certain laws of the conſtitution, which give an excitement to certain parts, at ſtated periods, and which no theory partially applicable will explain. There is a ſeries in which the parts of an animal body are matured, and a ſucceſſion in which the functions are brought to maturity: and in the female conſtitution, there are laws determining an action upon the womb and breaſts, and all parts ſubſervient to conception and the nouriſhment of a fœtus; at that period when the woman is arrived at the age fit to take upon her the part of a mother.

OF MENSTRUATION.

UNDER this head, I ſhall confine myſelf to ſuch a general view of the ſubject, as is neceſſarily connected with the peculiar functions we are now endeavouring to comprehend.

Menſtruation is a ſtate of preparation for conception. When, therefore, the menſes flow at the natural periods, and in due quantity, it is a ſign that the woman may conceive, and that her ſyſtem is fit for the ſupport and nouriſhment of a child. It is a general affection of the ſyſtem, which has a tendency to relieve itſelf by a topical action, by the excited action of the uterine ſyſtem; and this excitement of the uterine ſyſtem is the end which nature is accompliſhing. To explain this, I may be allowed to take a ſhort preliminary view: each particular organ or viſcus, whilſt it has its connections with the general ſyſtem, is, in truth, a ſyſtem within itſelf, having its peculiar functions, ſympathies, and even vaſcular action, in a certain degree, independently. Were not this, in ſome meaſure the caſe, we ſhould ſee no local diſeaſe or topical action; and no vaſcular action could be for a moment ſtationary and confined to one part. The body would, indeed, be then only one great hydraulic machine. But while the ſeveral parts have the property of being excited ſeparately to an accelerated action, they are actuated by remote ſympathies, and by theſe ſympathies and relations, is the whole ſyſtem in a great meaſure ſupported.

Before menſtruation commences, there is a preceding indiſpoſition, and ſymptoms indicating a conſtitutional affection. And theſe complaints are uſually more ſevere in the firſt, than in the ſubſequent periods. The general revolution in the ſyſtem begins to accumulate its action towards the womb, and thoſe ſymptoms uſually accompanying uterine irritation, ſhow how far it is affected, and in a little time the menſes flow. Now, I conceive, the flow of the menſtrual blood, to be not the end which nature is here labouring to accompliſh, but the means of allaying the excited ſtate of the uterine ſyſtem after the object is accompliſhed. It is not the diſcharge of a few ounces of blood which relieves the ſyſtem; for drawing blood ſimply will not do it; but it is the excited action of the uterine ſyſtem which relieves the general diſtreſs, and that topical action has full relief in the menſtrual diſcharge. General and topical plethora are terms which have been of great ſervice in explaining this periodical change in the female ſyſtem, but the ſtate of mere fullneſs, has little effect either on the conſtitutional or topical change. Even in the exhauſted and debilated ſtate of the ſyſtem, when menſtruation ceaſes from the want of energy and power in the vaſcular ſyſtem, ſtill there remain the ſame laws governing the ſympathies, and relations of the ſeveral parts; and although they are feebly and imperfectly excited, they give riſe to accumulated diſtreſs at the period in which the menſes ſhould flow.

There is more general diſtreſs at puberty, and when the menſes firſt flow; but afterwards, when the periodical action and diſcharge is eſtabliſhed, there is little or no previous indiſpoſition.

With regard to vicarious hæmorrhagy from remote parts of the body, ſome, whoſe opinion I greatly value, do not conſider them as deviations of the menſes. At all events, from what I have ſeen of ſuch hæmorrhagies (tumors, for example, diſcharging blood at the menſtrual periods), I would obſerve, that there is an excitement, throbing, and diſtenſion, previous to the diſcharge of blood, which confirms me in the notion of the neceſſity of a counter excitement and action, as well as the diſcharge of blood, being neceſſary to make a derivation from the uterine veſſels. It is by diſſection alone that we can form an eſtabliſhed opinion regarding the final uſe of the periodical return of the menſes.

By diſſection we come to the knowledge of the moſt eſſential facts. In the firſt place it is found, that the ovaria, and their veſſels, partaking of the general excitement of the ſpermatic arteries, are enlarged, full of blood, and with every ſign of increaſed action. We find alſo, that the ovaria are matured and brought to pubulate, and almoſt to ſtart from their inveſting membranes. Again, when we attend to the womb, we find, that theſe are marks of its whole vaſcular ſyſtem being rouſed to action. It has become laxer in its texture, and there is a change ſimilar to what takes place in the firſt ſtage of pregnancy, but leſs in degree. The veſſels on the inner ſurface of the womb have been influenced by an action ſimilar to inflammation, and it is aſſerted, that even the decidua is ſometimes formed. Thus, while the ovaria are ripened to that degree of maturity, which prepares them for impregnation, the ſurface of the womb, and its whole vaſcular ſyſtem, is preſerved in a ſtate of preparation for the adheſion of the ovum, when it ſhall have deſcended through the Falopean tube. I conclude that in conſidering this ſubject of menſtruation, the mere circumſtance of the diſcharge of blood has been too much attended to, while theſe other more eſſential circumſtances have been neglected.

It is not eaſy to determine, ſays Haller, either in this, or in any other ſpontaneous hæmorrhagy, from what kind of veſſels the blood flows. From the circumſtance of the hæmorrhoidal diſcharge, which certainly is from veins, and from the lochia, which is generally ſuppoſed to be a diſcharge from the venous ſinuſes of the womb after delivery, we have the argument of analogy, that in menſtruation alſo it is a venous diſcharge. This opinion is further confirmed from ſtagnant blood being found in the uterine veins of women dying during the flow of the menſes, and orifices being obſerved larger than could well be ſuppoſed to be the extremities of arteries.

I would ſay, that it is little probable that ſpontaneous hæmorrhagy proceeds from the rupture of the extreme arteries, becauſe it is the activity of the arteries which cauſes the hæmorrhagy; and becauſe this activity is the exertion of a muſcular force, and the exertion of a muſcular fibre never is ſuch as to tear the fibre itſelf. On the other hand, we obſerve that it is the neceſſary conſequence of an increaſe of the action of arteries, that the correſponding veins dilate, and ſeem to ſuffer a force of diſtenſion proportioned to their increaſed activity. We muſt not forget that many are of opinion, that the menſtrual blood flows from the exhaling arteries. This opinion muſt reſt upon argument, and not facts, unleſs the aſſertion of Raauw be taken as proof, that he could diſtinguiſh their mouths; or that of Mebomius, who ſaid he introduced briſtles into them. That anatomiſts have introduced briſtles into pores, or foramina, it would be ungracious to doubt, but that theſe were the orifices of exhaling arteries, is difficult to believe. I rather imagine, that there is a proviſion for this evacuation in pores, or foramina, in the extreme veins on the vaſcular inner ſurface of the womb.

From the conſideration of the cauſe of menſtruation, as I have conceived it, from the ſymptoms which proceed and accompany it, and from the effect attributable to the menſtrual action on the uterine ſyſtem, we cannot conſider it as a mere evacuation of blood, but rather as of the nature of a critical diſcharge relieving the ſymptoms which preceded it. With regard to the opinion of its being a ſecretion, we muſt firſt know accurately what is meant by the term. If thoſe who ſuppoſe the menſtrual blood a ſecretion mean only, that the blood is occaſionally changed by the action of the veſſels of the womb. I ſhould willingly acquieſce in their opinion, for even during the bleeding from the arm by the lancet, or from a common wound, the blood is altered in the ſpace of the few minutes during which it flows; and before the final ſtopping of a common hæmorrhagy, there is a change in the properties of the effuſed blood.

When there is an unuſual ſource of irritation in the womb, added to the natural and periodical excitement of the parts, the menſes become more profuſe, they laſt for a longer period, the time of their intermiſſion is ſhortened, and, in the end, from ſome diſeaſes of the womb, there is a perpetual oozing of blood, which debilitates the woman, and deſtroys her conſtitution, or there is ſudden and profuſe diſcharge with coagula, unlike the uſual evacuation.

OF THE CHANGE PRODUCED BY THE UNION OF THE SEXES.

In conſidering thoſe changes produced on the ovaria and womb by impregnation, we muſt have recourſe to analogy in the firſt inſtance. By attending to the changes produced in vegetables, and the lower animals, we may be enabled to comprehend ſome of the changes in the female organs conſequent upon conception, and which we might not otherwiſe be enabled to underſtand.

We ſee that vegetables propagate their branches in every reſpect like the parent trunk. We ſee in the autumn the bud lodged in the axilla of the leaf, and obſerve it paſs through the winter in a kind of dormant ſtate; but when it is influenced by the returning heat of the ſpring, it ſhoots out to full maturity. This growth is a natural power of propagation, and increaſe, marked by no very peculiar circumſtance, yet bearing a ſtrong analogy to the production of the ſeed.

In the formation of the fruit of the ſame tree, we ſee a more complicated proviſion for the propagation of the plant. We find that although the ſeed appears to be formed by the natural growth of the part like the bud, yet before it becomes prolific, and capable of growing, and arriving at maturity, it muſt be influenced by circumſtances ſimilar to the union of the ſexes of animals; that its power of reproduction depends upon the reciprocal action betwixt the parts of the ſame plant, or by the approximation of male and female plants.

Between the formation, maturity, and impregnation of the ſeed of plants, and thoſe of the ova of animals, there is a cloſe analogy. The ſeed is formed and matured while attached to the parent plant; but the veſſels of the plant having completed this operation, ſhrink from their connections with the ſeed, leaving it with its little ſyſtem of veſſels complete, and with a kind of imperfect life, which may be conſidered as analogous to a dormant ſtate. This imperfect life, or perhaps a ſtate merely capable of being excited into life and motion, continues for the winter ſeaſon, or for a longer period.

The flower of plants ſolicits the fluids to the ſeed, as the influence of the leaf cheriſhes the bud in the axilla. The pulp of the fruit is probably a proviſion of the ſame kind, or when it has fallen, to lay the foundation, by its decay, of a ſoil ſuited to the tender plant.

In the ſeed itſelf, we have much to admire. We find it incaſed in a ſtrong huſk, or ſhell, which is in general provided with a porous part ready to imbibe the moiſture of the ground. In the nut within the outer ſhell, there is a ſoft ſpongy ſubſtance, which, receiving the moiſture, ſwells and burſts up the ſhell, and relieves the ſeed. The kernel of the nut is then like a common ſeed, it has begun to vegetate, and theſe are the parts which form the ſyſtem of its œconomy. The principal part of the ſeed conſiſts of albuminous matter for the ſupply of the nouriſhment to the embryo plant, ſo as to prolong its ſhoots, and to ſend down its roots into the earth. The little embryo plant lies complete in all its parts, betwixt the lobes of albuminous matter, in a ſtate of torpor, or in which the operation of the living principle is ſuſpended. From the embryo plant there extends into the albuminous matter of the ſeed veſſels, or tubes, inactive, but ready on the ſupply of heat and moiſture, to abſorb the nutritious matter of the albumen, and miniſter to the increaſe of the embryo plant.

Now the root of the little plant ſprouts from the ſeed, and has a tendency to ſtrike into the ground, and the bud riſes to the ſurface towards the light, and the influence of the atmoſphere.

We ſee in this inſtance, that the operation of the ſyſtem of tubes of the embryo plant in the albumen was merely ſuſpended, that upon the ſeed being put into the ground, the heat and moiſture promote the germination, by driving the nutritious matter of the albuments to the embryo plant. In the firſt ſtage of this change, the matter abſorbed by the veſſels of the albumen ſupply that nouriſhment, which afterwards is conveyed from the root ſtriking into the earth, and from the leaves abſorbing from the atmoſphere. And when the roots have ſtruck into the earth, and the firſt leaves riſe upon the ſurface, the lobes of the albumen are exhauſted and fade, or riſe up in form of leaves, ſtill cheriſhing the tender plant.

When we come accurately to examine the ſituation of the embryo in oviparous animals, we ſhall find the ſame proviſion for the nouriſhment and growth of the young animals, independent of external circumſtances, nouriſhment prepared for it until it ſhall be enabled to gain ſtrength to feed itſelf.

The manner in which an egg is formed is this: The yolk, with its delicate membranes, are formed in the ovarium of the hen. The ovarium is placed on the back-bone, innumerable yolks are ſeen gradually formed, and ſucceſſively increaſing in ſize. When they are matured, they are of the full ſize we ſee them in the perfect egg; they are ſurrounded with a delicate web of membranes, extremely vaſcular, which burſts when they are mature and impregnated, and then they fall into, or are graſped by the infundibulum, or what anſwers to the Falopean tubes in woman and quadrupeds. While yet in the egg-bed, the cicatricula, or embryo, is ſeen to be included in its membranes, upon the ſurface, or in the membrane of the yolk; as the yolk, and the imbibed cicatricula, paſſes through the uterus, the yolk, in a moſt curious way, has the addition of the other part of the egg. The uterus of a bird is not like that of other quadrupeds or viviparous animals, ſimply for the reception of the ovum; but it is long and convoluted like the inteſtines. And the yolk, as it drops into the upper part of it, collects as it paſſes alongſt the uterus, the white of the egg, which is a ſecretion from it. As it proceeds downwards, it receives the membranes of the white, and before it is excluded, it is coated with the ſhell to preſerve it from injury when it ſhall be dropt from the hen. In the fully formed and incubated egg this is the ſituation of the parts. Under the ſhell is a membrane which inveſts the whole parts, but leaves a ſpace containing air in the greater end betwixt it and the ſhell. Within this membrane the glarry white of the egg is contained, and within the white or albuminous matter is the yolk. Under the membrane of the yolk, there is a ſmall ſpot of a lighter yellow than the yolk. This, upon examination is found to be a veſſicle, and within it we ſee a leſſer circle formed by an inner veſſicle: this is cicatricula, and within this the rudiments of the chick are contained. We may obſerve, that the yolk is ſpecifically lighter than the white; again, it is fixed, towards the two extremities of the egg to the albumen, or white, by the chalaza. Theſe are like twiſted cords, which ariſe from the yolk, and expand in the white, ſo that they take a pretty firm hold on its tenacious ſubſtance. Theſe chalaza are not fixed to the yolk in its axis, but to the ſide, ſo that the buoyancy of the yolk keeps it revolving as the egg is turned, ſo as always to preſent the cicatricula to the upper part of the egg, in whatever way it is placed; conſequently it is always contiguous to the body of the hen, ſo as immediately to receive the influence of the maternal heat. By incubation, the principle of life in the chick and its membranes is rouſed, and the firſt perceptible change appears in little bloody ſtreaks, which, running together, form a circle of veſſels, and, which, are ſeen to terminate in the umbilicus of the chick.

This vaſcular circle, the moſt beautiful appearance of any in the œconomy of animals, ought to be particularly explained. In Mr. Hunter's book treating of the blood, there is a plate which repreſents the embryo of the chick in the incubated egg, at three different ſtages of its formation, beginning with the earlieſt viſible appearance of diſtinct organization.—The preparations from which theſe figures are taken, form part of a complete ſeries contained in Mr. Hunter's collection of comparative anatomy.—They are meant to illuſtrate two poſitions laid down in his work, viz. that the blood is formed before the veſſels, and when coagulated, the veſſels appear to riſe; that when new veſſels are produced in a part they are not always elongations from the original ones, but veſſels newly formed, which afterwards open a communication with the original.

This to me ſeems an idea founded on a very limited view of the ſtate of the parts. We muſt recollect that

this

this is not the formation of new parts or new veſſels. The embryo is in that ſtate of which I have endeavoured to convey an idea, by the term dormant; poſſeſſing that degree of life which is to be renewed by incubation, or artificial heat, but which will laſt a great length of time, and, like the germ in plants, be brought to vegitate only in particular circumſtances. The tract of theſe veſſels is laid in the original conformation of the embryo and ſurrounding membranes, they are now merely called into action, and we ſee only the effect of this action. We ſee red blood formed; we know that the redneſs of the blood is derived from the membranes, and matter which ſurround the embryo, and that it is conveyed to the chick or embryo. Before we allow ourſelves to conjecture what is the firſt motion in the circle of actions which now take place, we muſt conſider whether it be not more likely that the firſt action of theſe veſſels is in abſorption; that is, an abſorption in the extremities of theſe veſſels, or is there firſt, an action of the heart of the chick?—We are left to this queſtion, Is it probable that a change ſhall take place in the fluids which ſhall ſtimulate the veſſels? or ſhall the heat of incubation ſtimulate the veſſels to act upon the contained fluids? or, as ſeems moſt probable, does the incubation, at the ſame time, produce a change in the fluids, and ſtimulate the veſſels to action? To explain what I ſhould rather conceive to take place, I ſhall deſcribe the probable ſeries of actions.

In common ſeed, the ſmall germ of the plant has its veſſels paſſing out into the lobes of the albumen to abſorb the food, upon the exiſtence of the peculiar circumſtances neceſſary to its being ſtimulated to activity and growth. We have to obſerve, that where the nut was attached in its huſk to the tree, it has left a porous part; by this cribriform kind of plate the moiſture of the earth enters;—that dry ſcurfy ſubſtance which we obſerve on the inſide of the ſhell, ſwells with the moiſture which alſo penetrates the albumen or kernel—the moiſture forming combination w[illegible] he albumen prepares it for abſorption; the veſſels are, at the ſame time excited, abſorb, and thus nutritious fluids are conveyed to the germ—the nut ſplits by the ſwelling of the parts, and the corculum or bud ſprouts up.—We find then, that in this inſtance the grain, or nut, is brought into action by the fluids abſorbed, forming new combinations with the albumen or kernel, and the active exertion of the living powers, beginning by an operation in the fluids.

In the ſame manner, I conceive, that the incubation of the egg cauſes an action firſt in the fluids, not in the ſolids (for theſe are ſolids according to the ſtricteſt ſignification of the term; and ſtrong membranes, as a little vinegar will ſhow, when poured upon the albuminous ſubſtance of the egg). A change takes place in the fluids, there are new arrangements ſuiting them for abſorption, by thoſe circles of veſſels which are laid on the original formation of the membrane. The fluids act as a ſtimulus to thoſe veſſels, whoſe alternate action and relaxation never ceaſe until the termination of life. I conceive this explanation, which I have offered, to be more conſonant with the great principles of phyſiology, and an extenſive analogy of ſimilar actions in the œconomy, than that ex-

planation

planation of Mr. Hunter, which ſuppoſes the ſpecks ſeen at the ſides of the veſſels, to be ſpots of coagulated blood, deſtined afterwards to become blood veſſels. For, I am apt to conceive, the red blood to be formed only after ſeveral rounds of the circulation, and to depend upon a more perfect aſſimulation than that firſt excited: and that Mr. Hunter is all along in this miſtake, that he is ſuppoſing theſe veſſels to be newly formed, which are laid in the conſtitution of the membranes ſurrounding the embryo, and which are now only called into action, and only become apparent when they convey red blood.

In the ſyſtem of the egg there are other circumſtances worthy of notice: as the chick grows by the abſorption of the white, or albumen, the new combinations reduce to a leſſer bulk the whole maſs, which is within the ſhell, and now we perceive the uſe of the air-cell, which enlarging, fills up this ſpace. When the chick has eſcaped from the ſhell, the yolk of the egg is not exhauſted, but it is found to be received into the belly of the chicken, and to have a conduit leading into the duodenum, by which it is poured into the inteſtinal canal. It is for ſome time a ſource of ſupply to the young animal until its ſtrength is equal to the digeſtion of its appropriate food. And in this reſpect it is analogous to the ſuckling of viviparous animals.

Let us now obſerve what analogy exiſts betwixt the generation, or rather the birth and nouriſhment of the embryo of the viviparous animal, and thoſe of the oviparous. As to the preciſe effect which the approach of the male has upon the ovarium of the female, whether by this union of the ſexes, there is an actual addition to the ovum, or only an influence exerted on the parts already there, by the preſence of the male ſemen, it ſeems almoſt needleſs to hope for an abſolute deciſion.

The reſemblance of the offspring to both parents, would influence us at once to conclude, that there muſt be a union of the parts from both ſexes. But when we conſider how much the peculiarities of individual animals depend upon certain peculiarities of action; how the conſtitutional prediſpoſitions muſt depend on the ſame peculiarities in the action of parts, ſince the doctrine of abſorption teaches us, that of actual ſubſtance nothing is permanent, but all ſuffers an inceſſant revolution and change, of which nothing can remain but certain peculiarities of action; we may then come to allow, that the male ſemen merely influences the ſtate of the parts already formed, and does not beſtow an actual ſubſtance.

In the ſpeculations on the ſubject of generation, facts and obſervations have been ſo very rarely attended to, that thoſe which have been offered ſeem to have had a preponderance much beyond their real value. Thus the microſcopical demonſtration of animalculæ ſwimming in the ſemen of the male, has given birth to an idea that they were homunculi, which being introduced into the proper nidus of the female, grew up to man's eſtate. Though, where all is conjecture, and, perhaps, as no better explanation is to be offered, it may ſeem improper ſo directly to contradict any theory, ſtill I muſt ſay, that this is, in my mind, the height of abſurdity. To ſuppoſe an animal ſecreted alongſt with the ſeminal fluid from the teſticle of the male (and which, in all probability, is the production of ſtagnation and putridity), to ſwim and be nouriſhed in the male ſemen, and yet to hold that on being introduced into the ovaria, it changes from an active animal into an impalpable gelatinous-like maſs, and, after a ſeries of changes, grows at laſt to the maturity of a human being, is altogether beyond my comprehenſion.

The experiments made by the ingenious Dr. Heighton, throw conſiderable light upon theſe deluſive ſpeculations regarding the impregnation of the female. He found by experiments on rabbits, that upon cutting the Falopean tubes, forty-eight hours after the coitus, the impregnation was equally obſtructed as when he had cut them previous to admitting the male; it would appear that in theſe animals impregnation is by no means the inſtantaneous effect of the union of the male and female, but that it requires at leaſt fifty hours; for, when Dr. Heighton cut the Falopean tubes at that period, it did not prevent impregnation. Dr. Heighton proves, that the generative proceſs is not an inſtantaneous effect, as we ſhould very naturally ſuppoſe, but an operation requiring time. That the ſemen does not reach the ovaria during, or immediately after the coitus, is ſufficiently evident; and it is ſtill more ſo, that the ovum is impregnated while in the ovarium, and not upon its deſcent into the womb, which is proved from the fœtus ſometimes remaining in the ovarium, or tubes, and growing to maturity. Dr. Heighton ſuppoſes the ſemen only to affect the vagina and uterus, and that a conſent of parts, or ſympathy, is communicated along the tubes and ovary to the ovum; and that neither the ſemen, nor the aura ſeminalis reaches the ovaria. When we look abroad for analogies, however, and find the ſemen of ſome animals, as fiſhes, merely thrown out upon the already evacuated ſpawn, we cannot readily acquieſce in this opinion of the mere ſympathy of the female parts calling the young animal into life.

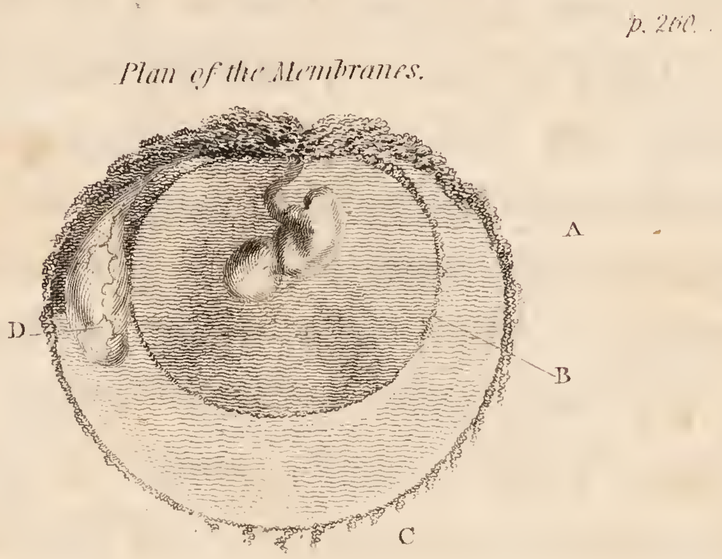
Leaving this ſubject, we have to obſerve, that previous to impregnation there is a ripeneſs and prominence of ſome of the ova, that by coition the Falopean tubes do not inſtantly graſp, impregnate, and cauſe the burſting of the ovum from the ovarium; but there is an action commenced which gradually brings about this change. Whilſt the ovary is thus affected, the tubes are preparing for their action of embracing the ovum, there is an increaſed turgeſcence in their veſſels, and an enlargement and ſwelling of the fimbriated extremity. When thus prepared, it approaches the ovarium, graſps, and receives the ovum, and by a periſtaltic motion, probably very ſlow and gradual, the ovum is conveyed into the cavity of the uterus.

OF THE OVUM, AND ITS CONNECTIONS WITH THE UTERUS IN THE EARLY MONTHS OF PREGNANCY.

THE ovum, when it has deſcended into the uterus, and is perfect in its ſtructure, is a ſoft oval maſs, fringed with veſſels, and compoſed of membranes containing the early fœtus. When opened, or diſſected, it preſents three cavities, or we obſerve the fœtus to be ſurrounded with three diſtinct membranes. The

1. Decidua, or tunica filamentoſa, falſe chorian, or ſpongy chorian. 2. The chorian. 3. The amnios. Of theſe coats, the outer one is formed by the womb, the others conſtitute the ovum as it has deſcended from the ovarium. We ſhall, in the firſt place, attend to the original membranes and general conſtitution of the ovum, and then to the deciduous covering which it receives in the womb.

Plan of the Membranes.



A, The Fœtus. B, The Amnios. C, The Chorian. D, The Veſicula Alba.

Amnion. The amnion is the veſicle which immediately involves the fœtus. It is a very thin and pellucid membrane in the early ſtage of pregnancy, but it acquires conſiderable thickneſs and ſtrength in the latter months.

The amnion contains a thin watery fluid in which the fœtus is ſuſpended. In the abortion of the early months, we find the quantity of this fluid very great in proportion to the whole ovum, and this forms a defence to the delicate, and almoſt gellatinous ſubſtance of the fœtus, while it is a proviſion alſo for the regular preſentation of the head of the child, for now the fœtus being ſuſpended in this fluid, and hanging by the umbilicus, and the head and upper part of the body greatly preponderating, it takes that poſition with the head preſenting to the orifice of the womb which is neceſſary to natural and ſafe labour, the fœtus being prevented from ſhifting in the latter months by the cloſſer embracing of the child by the uterus.

CHORIAN. The chorian is the ſecond involving membrane of the fœtus; on the inſide it is ſmooth, and betwixt it and the amnion a gelatinous fluid is interpoſed. In the early months it is much ſtronger than the amnios, but in the advanced ſtage it has come in contact with the amnios, no fluid being betwixt them. And in proportion as the amnios gains ſtrength to be of eſſential ſervice in dilating the orifice of the womb during labour, the chorion has relatively become very thin and weak. On the outſide the chorion is ſhaggy and vaſcular, and conſtitutes thoſe minute extremities of the vaſcular ſyſtem of the ovum, which attach to the ſurface of the womb, or rather to the flocculent membrane which it throws out.

THE UMBILICAL CORD. When we can firſt decern the fœtus, it is merely like an opaque oval body of the ſize of a common fly, and cloſely attached to the amnion; but, by degrees, it recedes from it, and then we perceive that it is attached by the umbilical cord, which conſiſts of the trunk of the veſſels going out from the fœtus, and which diſtributed upon the chorion receive the ſupplies from the maternal ſyſtem.

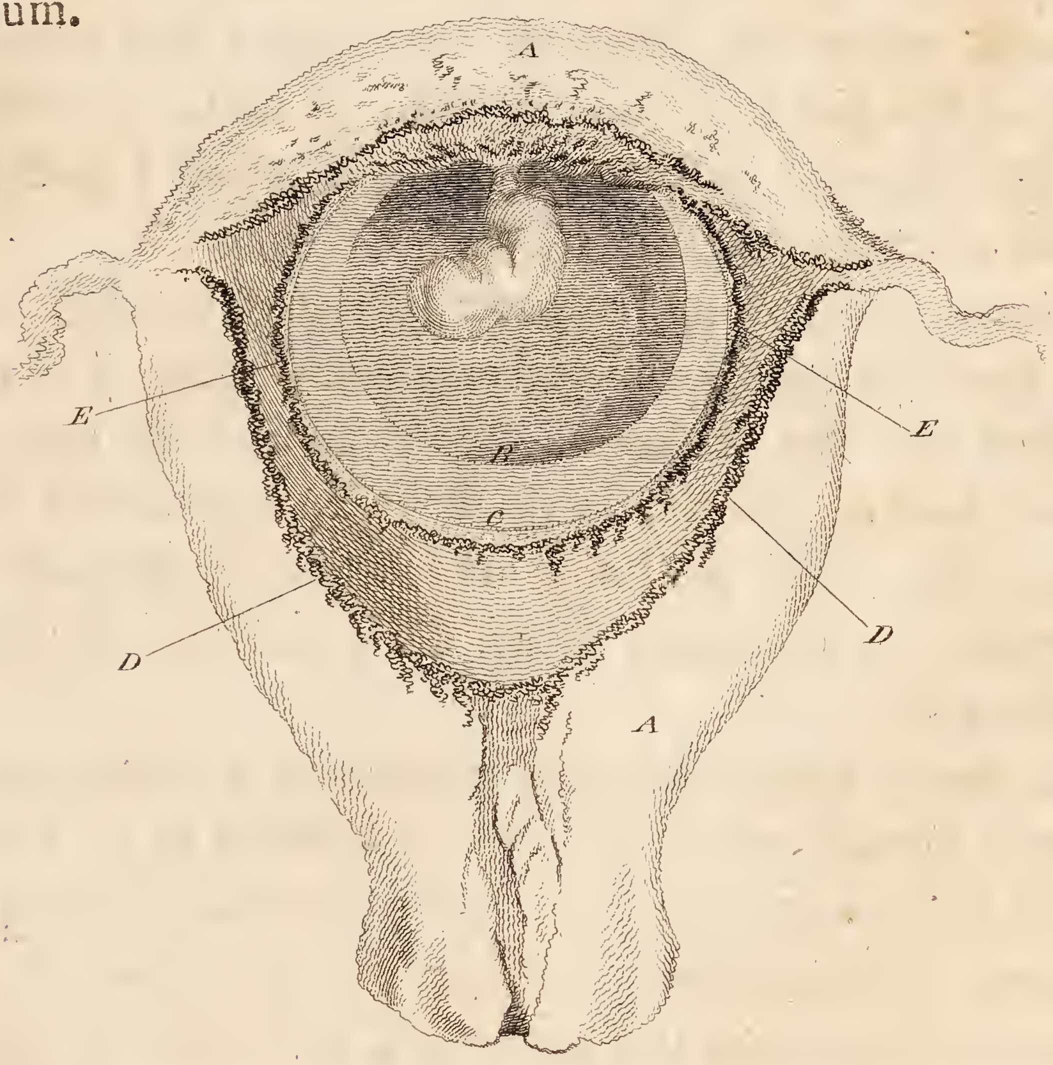
Now we perceive that the fœtal ſyſtem which deſcends from the ovarium, is not merely a fœtus or embryo, but that this embryo, beſides a ſyſtem of veſſels within its own body, is ſurrounded completely with membranes, and that from the vaſcular ſyſtem of the embryo, there go out veſſels, which being minutely diſtributed to the outer veſicle, or membrane, and actuated by the ſame heart which circulates the blood through it, our little corporal ſyſtem prepares for imbibing the due nouriſhment from the uterus.

Vesicula alba. The veſicula alba, or umbilicalis, is a little veſicle which lies betwixt the chorion and amnion; it contains a white fluid; it is connected with the naval or cord, by an artery and vein. Very little has been offered as explanatory of its uſe, it has been conſidered as ſimilar to the alantois of quadrupeds, and having a connection with the urachus; but it has no communication with the bladder, and ſoon diſappears. Whereas, if it had been for receiving the ſecretion of urine, it would have been prepared for the more mature ſtate of the fœtus.

I conceive it not to be improbable, that it is a proviſion of ſupply for the embryo, previous to its perfect attachment to the uterine ſyſtem, and during its deſcent into the womb, perhaps ſimilar to the albumen of oviparous animals, but which, after the perfect eſtabliſhment of the connection betwixt the fœtal and maternal ſyſtem, ſhrinks and diſappears, as being no longer neceſſary.

OF THE ADDITIONAL MEMBRANES WHICH THE OVUM RECEIVES FROM THE UTERUS.

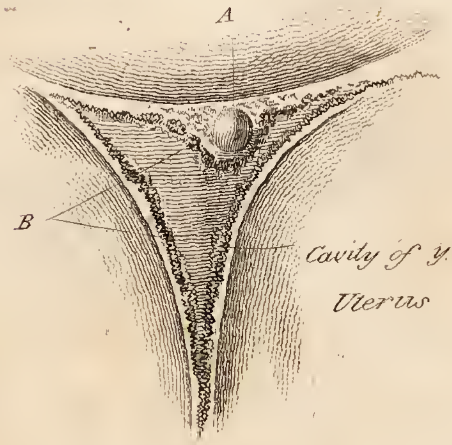
WHILE the ovum is taking the changes conſequent upon impregnation, the womb partaking of the general ſympathy which prevails over the whole uterine ſyſtem, takes a change adopting it for its reception. The firſt appearance of action is marked by a greater activity of the veſſels, a ſwelling and ſoftneſs of its ſubſtance. While on the inner ſurface there is an exudation which being converted into a ſpongy membrane, is peculiarly adapted for the reception and adheſion of the ragged and vaſcular ſurface of the ovum.



In this plan we ſhall be able to obſerve the relations and inflections of the uterine membranes or decidua, as ſeen and deſcribed by Dr. Hunter, and of their correctneſs, my obſervations in diſſection leave no doubt in my mind. AA, The uterus in out-line; B, the amnion with the fœtus; C, the chorion. Now it is obſerved, upon a careful examination of an abortion of the early months, that beſides the chorion and amnion, there is a ſpongy membrane of two diſtinct lamina which inveſts the chorion. The outermoſt of theſe is found to ſurround the whole ovum, even inveſting that part which has become the placenta by the accumulation of veſſels. This outer membrane then may be repreſented by the line DD. It is repreſented as adhering to the ſurface of the womb, as it muſt do in fact. We obſerve again, that it is perforated where the Falopean tube enters the womb, that at this part it is not formed; ſo that, according to Dr. Hunter, and the preparations which I poſſeſs, theſe tubes open into its inſide.

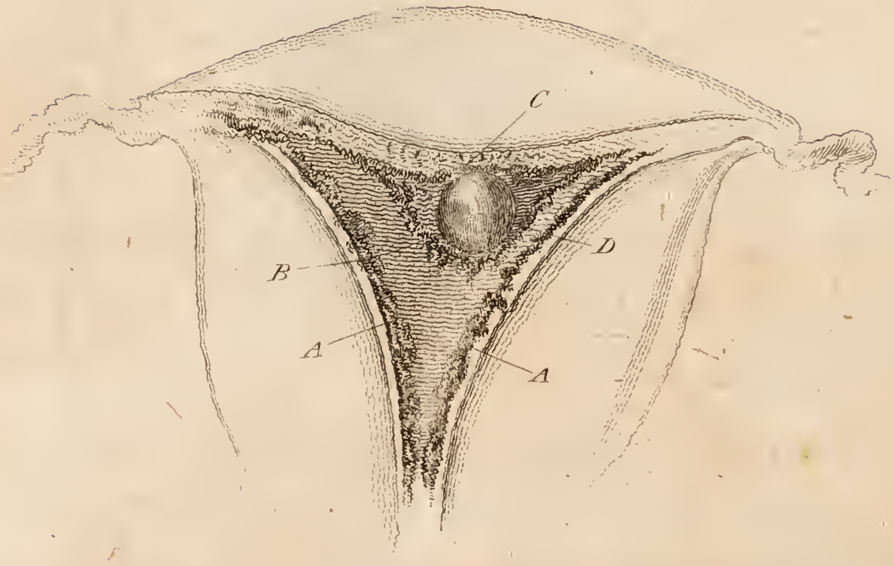
Upon diſſecting up the outer lamina of the decidua, we find that where the placenta commences, it is reflected over the ſurface of the ovum and the ſhaggy chorion of the ovum, ſo as to be repreſented by the letters EE. We ſhall now underſtand the diſtinction betwixt the DECIDUA VERA DD, and the *Decidua Reflexa* EE.

It would appear that this membrane is either completely formed, or at leaſt the fluid which is to form it, is thrown out previous to the deſcent of the ovum; indeed, ſo intimate is the ſympathy betwixt the whole uterine ſyſtem, that this membrane is formed in thoſe caſes where the ovum does not deſcend, but conſtitutes the extra uterine conception.



Dr. Hunter ſuppoſed, that the ovum paſſed into the cavity of the uterus whilſt the coagulable lymph was pouring out by the arteries of the uterus, and that it was thus immerſed in, and ſurrounded by the decidua, for he could not conceive that it could gain admiſſion betwixt the lamina of the membrane already formed.

I ſhould conceive that the ovum A, upon its deſcent gets intangled behind the deciduous membrane B, by which means the ovum is not left looſe in the cavity of the womb, but is ſoon attached and ſurrounded with a membrane, or vaſcular web, from which it can immediately draw ſupplies, and by this proviſion alſo its adheſion to the ſuperior part of the uterus is inſured. But as the ſame action of the uterus continues, and, as we muſt naturally ſuppoſe, be rather occaſioned by the preſence of the ovum in its cavity, the ſurface of the uterus at A continues to throw out a coagulable matter which ſurrounds that part of the ovum, ſo that this will immediately become its ſituation.



A, The *Decidua Vera*, formed before the deſcent of the ovum. B, the *Decidua Reflexa*, formed by the ovum getting behind it, and puſhing it down. C, the effloreſcence which continued to be poured out, ſurrounds the upper part of the ovum, and which, from its more immediate ſupply from the uterus, will in time form the ſole ſupport of the fœtus, viz. the uterine portion of the placenta.

OF THE PLACENTA, AND OF THE NUTRITION OF THE FŒTUS.

WHEN the ovum firſt deſcends into the uterus, the fleecy ſurface of the chorion eſtabliſhes a univerſal adheſion, but no ſooner is the attachment of the ovum eſtabliſhed, than the veſſels of the fœtus which are univerſally diſtributed over its ſurface, begin to accumulate to that point from which the more abundant ſupply is obtained. Thus, from the univerſal adheſion the veſſels of the fœtus are maſſed and accumulated together, ſo as to form a thick cake or placenta. This takes place upon the ſame principle that the roots of a plant ſtretch towards the ſoil beſt ſuited to it, or the branches and leaves of a plant grow and ſpread towards the light. The placenta is deſtined to adhere to the fundus of the womb, and there we obſerve the accumulation of the large veſſels of the womb, it being equidiſtant from the ſeveral ſources of blood; and to this point is the tendency of the veſſels of the chorion ſo great, that we ſometimes ſee the veſſels of the cord running three or four inches upon the membranes before they reach the placenta, evidently ſhewing that the point to which the umbilical cord had been originally attached, was not oppoſite to the more vaſcular part of the womb; but that the veſſels had to ſtretch and elongate ſome way from the inſertion before they accumulate in form of the placenta, towards that part of the uterus where there was the greater vaſcularity.

But the formation of the placenta on the fundus of the womb is not conſtant, although there are many proviſions for enſuring attachment there. But when it does form low in the womb, or on the orifice itſelf, we then perceive the reaſon of nature's ſolicitous care in preventing it; for it occaſions the moſt dangerous floodings from the placenta preſenting on the approach of labour, and its connections being neceſſarily torn up previous to the delivery of the child.

The placenta of the advanced ſtage of geſtation is a maſs formed partly by the accumulations of the veſſels of the fœtus (the trunk of which is the umbilical cord), and partly of a vaſcular and cellular portion formed by the uterus. On the ſurface attached to the womb, the placenta exhibits deep and irregular fiſſures which divide it into lobes; but on the inner ſurface is ſmooth from the inveſting membranes, but raiſed into irregularities by the numerous and tortuous ramifications of the umbilical veſſels. When rudely torn or cut into, it appears to be a ſpongy ſubſtance, formed in a great part of an irregular tiſſue of veſſels.

In the human ſubject we find, that the maternal part of the placenta is thrown off with the other ſecundines, and does not ſeparate from the fœtal part of it. While, in other viviparous animals, the monkey excepted, the filamentous extremities of the fœtal veſſels ſeparate from the glandular maſs formed by the maternal veſſels of the uterus.

The placentary veſſels of the fœtus never touch the ſurface of the womb, but communicate with the maternal ſyſtem through the veſſels of the womb, which pierce the deciduous membrane. Still the queſtion of the preciſe manner in which the veſſels of the fœtus communicate with thoſe of the mother remains undetermined. I conceive that in the early ſtage the deciduous membrane being thrown out by the action of the uterine veſſels, thoſe of the chorion ſtretch into it, and abſorb the nouriſhment. The decidua is a vaſcular membrane, but it has, at the ſame time, a peculiar ſpongy texture. This ſpongy, or reticulated ſtructure of lamina of the decidua ceaſes where the placenta is affixed. When we carefully diſſect up the decidua to the margin of the placenta, it is found to be be more rigid, white, firm, and thick *. When we examine the outſide of an entire ovum, we obſerve that at the place covering the placenta, it is corrugated and full of irregular eminences like the convolutions of the brain, and amongſt thoſe irregularities many ſmall convoluted arteries may be diſcerned, with ſpots of extravaſation and the flat mouths of veins. Upon diſſecting up this maternal part of the placenta, we find it to form the firmeſt part of it; and by the difference of colour, as well as by the poſſibility of tearing it up, or diſſecting from the maſs of veſſels of the chorion, we recognize it as the decidua. This union, however, betwixt the maternal and fœtal parts of the placenta is intimate, and it is impoſſible to determine by diſſection with the knife, whether there be inoſculations betwixt the maternal and fœtal veſſels, or whether the nouriſhment of the fœtus is by abſorption, nor can we diſtinguiſh in the firſt months the cellular intertexture which may be obſerved in the placenta of the full time, as deſcribed by Mr. Hunter.

In explanation of this part of our ſubject, I have purpoſely diſſected, and made drawings of the ovum in ſeveral ſtages. This point of anatomy relating to the decidua, is particularly explained in Plates VI. and VII. to which I refer the reader.

OF THE LIQUOR AMNII, AS CONDUCING TO THE NOURISHMENT OF THE FŒTUS.

SOME phiſiologiſts obſerving the ſtrict analogy, which exiſts between the function of the placenta and

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* I ſpeak after diſſecting the ovum of the third month.

the lungs of breathing animals have conceived, that the liquor amnii is the ſource of nouriſhment, and that it is taken into the ſtomach. I believe they have conceived ſome analogy to exiſt betwixt the albumen of the egg and the liquor amnii, which in their minds has ſtrengthened this opinion. But there is here no analogy; we have ſeen, that the embrio of oviparous animals being formed with the yolk in the egg-bed or ovarium, deſcends into the uterus, and there receives the addition of the albumen or white. On the other hand, we find that the ovum of viviparous animals is formed in the ovarium; and that the liquor amnii being within the membranes of the ovum, muſt be the production of the fœtal ſyſtem. Further, when the ovum has deſcended into the womb, and grown to ſome maturity, we ſee that there is no connection by veſſels betwixt the fœtus and mother but through the placenta; that the liquor amnii is within the involving membranes of the fœtus, and that conſequently it muſt be thrown out by the veſſels of the fœtal ſyſtem. Thus, to ſuppoſe the fœtus to be fed by the liquor amnii, would be to ſuppoſe it to draw reſources from its own ſyſtem, and that the veſſels poured out a fluid, which is afterwards to be taken into the ſtomach *. But without adducing arguments, it is ſufficient to ſay, that fœtuſes have been brought forth, monſtrous in their conformation, and without mouths yet well grown.

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* A greater abſurdity than that of which a foreign author is guilty cannot be imagined, becauſe the liquor amnii, or ſome fluid, is found in the trachia, he ſuppoſes that the fœtus reſpires, and receives oxigination from the liquor amnii.

OF THE PLACENTA AS THE SOURCE OF NOURISHMENT TO THE FŒTUS. When we conſider the mere ſpeck of the embrio in the firſt weeks, we ſee that it can have no other ſource of nouriſhment than through the extreme veſſels of the chorion, connected with the ſhort umbilical cord; and we may be convinced alſo, that in its progreſs to maturity, when the general connections of the chorion ceaſe, and the placenta is formed, the ſole ſupply is through its veſſels. Regarding the manner of the communication betwixt the veſſels of the mother and child there are many opinions. The ſimpleſt explanation, but the furtheſt from the truth is, that the arteries of the womb are continued into the veins of the fœtal portion of the placenta. That on the other hand, the arteries of the fœtal ſyſtem are continued into, or inoſculate with the veins of the womb; and that thus, the blood of the mother's ſyſtem is carried by direct inoſculation. A little inveſtigation will convince us, that this is a very unlikely conjecture. We ſee the embrio ſurrounded with its veſſels, and forming a complete ſyſtem within itſelf, deſcend into the womb. We ſee that the attachment betwixt the ſurface of the ovum and the womb, depends on a reciprocal action betwixt them; and when the fœtus is feeble, or diſeaſed, or when it dies, the uterus immediately ſeparates from it, as from a dead part, and there is an abortion. Again, it is not natural to ſuppoſe, that the circulating fluids of the adult are calculated for the circulation in the embrio, or that the blood of the adult is fit for the circulation of the fœtus. When we inject the veſſels of the fœtus, we find the veins and arteries of the umbilical cord to inoſculate freely with each other, and the fluid paſſes from the arteries to the veins with little extravaſation or eſcape of fluid, and ſuch only as may be ſuppoſed to paſs from torn veſſels. Again, the bleeding of the child does not draw from the maternal ſyſtem; for example, when the accoucheur has to perform the operation of embrioulcia, and when the arteries of the brain pour out their blood, the woman does not ſuffer, nor is there any danger of hæmorrhagy from the cord after the delivery of the child. Again, what does the analogy of other animals ſhow us? We may obſerve, in the firſt place, that probably on account of the peculiar form of the womb of woman, and in theſe circumſtances to guard her from danger of hæmorrhagy during delivery, it is neceſſary that the placenta ſhould be accumulated towards the fundus of the womb. Now, to allow leſs danger of the ſeparation of the ſecundines from the womb, and conſequent abortion, there follows a neceſſity for the human placenta being attached in a particular manner; and in place of the maternal part of the placenta remaining with the womb, as in other animals, the whole maſs ſeparates on the delivery of the child. The neceſſity for this firmer attachment of the human placenta, cauſes the connection betwixt the fœtal and the maternal portions to be very intimate, and the manner of the vaſcular connection by no means eaſily demonſtrated.

In other animals, however, for example in thoſe which have the ſmall and numerous placenta, or colylidones, the fœtal and maternal portions of the placenta ſeparate eaſily; the maternal part being a prominent vaſcular bed, which is a part of the womb, and is not deciduous. Here we find, that the glandular-like portion which belongs to the womb may be minutely injected, and no particle of colour paſs into the fœtal part; and again injection ſhows the fœtal portion to be merely compoſed of the fleecy extremities of veſſels, which, however, minutely injected, do not ſhow any inoſculations with the maternal veſſels; in ſhort, here the connection betwixt the extremities of the two ſyſtems is ſo very looſe, and the filaments ſo minute, and almoſt like an impalpable mucus, that we can imagine no other kind of connection than that the extremities of the umbilical veſſels take up by abſorption the nutritious matter neceſſary for the ſyſtem of the child, and that this is ſecreted by the veſſels of the womb.

Inveſtigation in every department of natural hiſtory ſhows a ſimilarity, and a ſimplicity in the operations of nature. Comparative anatomy may be brought with much advantage in illuſtration of the very obſcure laws which guide the functions of the parts of generation. When we turn our attention to the egg, we find, in the firſt place, that the vaſcular ſyſtem is complete within itſelf, and requires no permanent connection with the maternal ſyſtem to invigorate its action. We find that the artery which paſſes out of the umbilical cord of the chick, and which is diſtributed to the membranes of the white, pulſates ſtrongly, and carries venous coloured blood. We find the returning vein carrying arterial coloured blood. We find then that theſe veſſels muſt have a double function, they imbibe the nouriſhment from the white, and convey it to the increaſe of the chick; and they at the ſame time,

perform

perform an action ſimilar to that of the pulmonary veſſels of the adult, ſeeing that they carry out dark-coloured blood, and convey it back to the chick, of a bright vermilion colour. Now, I do not conceive, that this change upon the blood is performed by the communication with the atmoſphere through the ſhell, for I ſee no diſtinction in the colour of the veſſels, which are contiguous to the membrane of the ſhell, and thoſe which are removed from it by the expanding of the air-cell. Further we find, that there is an intermediate kind of generation in fiſhes which are oviparous, but retain the egg within their womb, until the fœtus is matured; here no communication with the air or water can be allowed.

Since we ſee that the chick in ovo is capable of miniſtering in every eſſential particular to its own increaſe, wherefore ſhould we ſuppoſe that the fœtus of viviparous animals has any other more particular connection with the womb of the mother?—The difference is in my mind this ſimply; the ovum of the oviparous animals deſcending through the convoluted and inteſtinal-like womb of the hen, accumulates a quantity of matter around it, which ſerves every purpoſe of nutrition when the embrio ſhall be finally ſeparated from the maternal ſyſtem; but in the viviparous animals the ovum deſcending into the womb remains there, and has an inceſſant ſupply of nutritious fluid, ſecreted from the veſſels of the womb, as it is required by the appetency of the fœtal ſyſtem. As in the egg, the membranes ſurrounding the white have the ſame effect upon the blood, which is afterwards produced by the lungs; ſo has the placenta of viviparous animals the double function of ſupplying nouriſhment, and the oxigination of their blood. The umbilical vein carries back pure arterial blood, and the common opinion is, that the blood of the fœtus coming in contact with the blood of the maternal ſyſtem, receives the principle from it, which beſtows this quantity of colour, with other neceſſary qualities, of which this of colour is but the ſign to our obſervation. It is not neceſſary to this change on the fœtal blood, that it ſhould come in immediate contact with the maternal blood, for it is poſſible, nay probable, that the matter thrown out by the maternal veſſels, whilſt it is nutritious, has alſo in it, in a condenſed, and not a gaſeous form, that which is eſſential to the change of the blood of the fœtus from the modena colour to bright vermilion.

OF THE EXTRA UTERINE CONCEPTION.

We find ſome curious facts relating to the action and ſympathy amongſt the parts of generation, proved by the caſes of extra uterine conception. When nature, baulked and interrupted in her uſual courſe of operation, ſhows unuſual reſources, it would appear, that the ovum, after impregnation, has in ſome caſes remained attached to its original ſeat in the ovarium, perhaps owing to ſome want of due ſympathy and ſynchronous action of the Falopean tubes, which ſhould graſp and receive the ovum. In other inſtances the ovum has been received into the Falopean tubes, but either from a want of ſufficient dilatation and action in them, they have not been able to propel it forward, or the ovum taking upon it that action which is deſtined to form its connections with the uterus, adheres, and is enlarged in the tube, ſo that it cannot be conveyed down into the womb.

But the moſt curious inſtance of the extra uterine conception is, where after impregnation the ovum has dropt from the ovarium, and lies in the cavity of the abdomen amongſt the viſcera. Here alſo the veſſels of the fleecy chorion ſpread, and attach themſelves to the ſurface of the viſcera.

Theſe inſtances of deviation from the natural action of the parts after conception prove to us, I think, that from the moment of impregnation there is a principle of life and activity in the ſyſtem of veſſels of the ovum, and that at a ſtated period this action becomes ſuch, that the efflorеſcent veſſels of the ſurface of the ovum, attach themſelves to whatever vaſcular ſurface they are in contact with. Further, it ſeems to ſhew, that in the womb, and in the deciduous membrane which it prepares for the reception of the ovum, there is nothing very particularly neceſſary, and that any vaſcular ſurface will take upon it the ſame changes, and being excited probably to ſome peculiarity of action, will in every thing eſſential ſupply the growth and nouriſhment of the ovum and fœtus.

It ſhows us how far the action previous and conſequent to impregnation is a univerſal and ſympathetic excitement of the uterine ſyſtem; that the decidua is formed in the cavity of the womb, although the ovum does not deſcend. This points out to us how careful nature is, that there ſhall be a reciprocal action in the ovum and womb, ſo as to enſure the adheſion of the ovum, and the ready ſupply of a proper nidus for it, when it ſhall have deſcended into the cavity of the womb. It informs us, that the uterus is a ſpongy and vaſcular bed, having peculiar ſympathies which actuate its veſſels, and a form of veſſels adapted to quick acceleration of action ſo as to grow, enlarge, and ſupply the ſecundines with nouriſhment.

It is not, however, in the mere adheſion and ſupply afforded to the fœtus, that the peculiar adaptation of the womb for the reception of the fœtus is ſhown, but in the proviſion for the delivery of the child at a regular and ſtated period. For, it is a curious fact, that in the caſe of extra-uterine fœtus, on the expiration of the nine months, the uterus takes upon it that action, and that excitement of its muſcularity which is deſtined to expel the fœtus. Accordingly we find, that at the uſual time of utero-geſtation, there are pains excited, and flooding, with the diſcharge of the decidua from the womb, although it contains no fœtus.

Nay, further it would appear from the reſult of ſeveral caſes, that at the expiration of the natural term of utero-geſtation, the fœtus indicates that it is governed by preſcribed laws, which render a change neceſſary, and ſhow that its ſyſtem is no longer fit to be ſupplied through the placentary veſſels, and as in the ſituation of extra-uterine fœtus this change cannot take place, it dies and becomes with its ſecundines, as a load of foreign or dead matter in the belly. This event is generally followed by the death of the mother, though ſometimes an abſceſs has opened and diſcharged the fœtus, or after much ſuffering, the bones have been diſcharged by ſtool, with much matter and colliquative diarrhæa.

OF THE WOMB AT THE FULL PERIOD OF GESTATION AND OF DELIVERY.

To complete this view of the female parts of generation, it remains only to ſpeak of the ſtate of the parts at the full term of nine months, and to obſerve the proceſs of a natural delivery.

The rapid increaſe of ſize of the pregnant womb in the ſhort ſpace of nine months, is perhaps the moſt ſurpriſing phenomenon of the whole animal œconomy, it ſhows the power of a peculiar excitement in calling into action a partial and local ſyſtem of veſſels. This ſtate of pregnancy is the furtheſt from a ſtate of diſtention, in ſo much, that it is obſerved the wombs feels peculiarly ſoft on impregnation, and as if but imperfectly filled by the ovum. This ſoft ſtate is a ſign of vaſcular action. We may often obſerve in the diſcuſſion of a tumor, that before any change takes place, it ſwells and becomes ſoft, and this even where the tumor is about to be abſorbed.

The fundus of the uterus is the part firſt enlarged; and afterwards the inferior parts; at length the cervix is obliterated, and the uterus, which was originally pyriform, becomes nearly oval, and the diſtention, as we have remarked, is greateſt on the back part of the womb. In the firſt months the uterus ſinks lower in the pelvis, they ſay, from its weight, but the ſpecific weight of the uterus is not increaſed, and on that account it ſhould not ſink deeper; it is, perhaps, rather from its enlargement, and the difficulty with which the fundus makes it way among the viſcera in the brim of the pelvis. Having deſcended conſiderably, the os tincæ projects further into the vagina, but the fundus continuing to enlarge, at laſt emerges from the circle of the bones, and then from the conical form of the uterus, it ſometimes riſes ſuddenly out of the pelvis; now the vagina will be found elongated, and the os tincæ removed from the point of the finger.

Now the ligaments of the womb direct it forward, and it riſes cloſe upon the abdominal paries, and before the bowels; in the firſt pregnancy it riſes almoſt directly up; in ſubſequent pregnancies from the greater relaxation of the integuments and the abdominal muſcles, it is allowed to fall more forward; about the fourth month of pregnancy, the womb may be felt in the abdomen, and riſing out of the pelvis; in the fifth month the fundus is about half-way betwixt the pubes and navel; in the ſeventh, it is about half-way betwixt the navel and ſcrobiculus cordis; in the eighth, it is at its higheſt, and towards the end of the ninth month, it rather ſubſides. Finally, immediately before labour it deſcends remarkably, and ſhifts into the middle of the pelvis, ſo as fairly to preſent the orifice of the womb.

The muſcularity of the uterus is increaſing from the firſt moment of pregnancy. As the uterus increaſes in thickneſs and is diſtended, the muſcular fibres become more diſtinct, and their power of contraction greater; but what is very particular is the great muſcular efforts made by the womb during labour by theſe fibres, which have not till that time felt the ſtimulus to action, or been allowed to contract.

When the period for the approach of labour is arrived, the nature of that viſcid ſecretion which ſeals up the orifice of the womb is altered, it loſes its viſcidity, and all the parts are relaxed and prepared for the tranſmiſſion of the head; even thoſe rigidities, ſtrictures, or calloſities of whatever kind, which would ſeem to promiſe an abſolute obſtruction to the paſſage of the child, yield and relax previous to labour. The action of the womb is at firſt feeble, as might be expected, and accoucheurs have marked theſe ſtages of a natural labour.

1ſt. The womb has ſuffered no diminution of its ſize; the membranes are entire, and, of courſe, the contractions of the womb are feeble, becauſe before it is allowed to make ſome contraction its efforts are not ſtrong. This is a proviſion for the firſt ſtage of labour being ſlow; by and bye the orifice dilating, the membranes with the waters are felt protruding. The membranes and water is as a ſoft conical cuſhion, gently dilating the paſſage; and in this ſtage there ſhould be no officious interference. While the membranes are entire, both the mother and child are in perfect ſafety.

2d. The orifice continuing to dilate, and the efforts of the womb increaſing, the membranes burſt, and the head of the child preſſes on the orifice; then the womb is allowed to contract: this contraction is a ſtimulus to greater efforts, and, in a few pains, the head deſcends in to the cavity of the pelvis. The orifice is completely retracted, and there is no longer a mark of diviſion betwixt the womb and the vagina; they are as one canal. If, however, the membranes are burſt too early, the labour is not accelerated, but retarded. The orifice is not dilated by the ſoft and elaſtic membranes; the head of the child preſſes broad on the orifice, which becomes rigid, and perhaps inflamed, its dilatation is ſlow, and the labour tedious. Though, from the form of the bones, and particularly by the retiring of the ſacrum, there is a proviſion and guard for the ſoft parts of the mother againſt compreſſion by the head; yet nature intends this ſtage to be ſhort, for it is the period of danger. There is now obſtruction of urine and fæces, and the veſſels of the parts ſuffer compreſſion.

3d. Now the head of the child preſenting at the orifice of the vagina, forms a third ſtage; it is the ſtage of moſt exquiſite ſuffering: the head is puſhed forward during every pain, and recedes again in the abſence of pain. An interval of reſt precedes this ſtage, at laſt the pains return, and the hard head of the child coming to preſs on the orifice, and the womb coming in cloſe contact with the body of the child, the pains are redoubled in ſtrength. The face of the woman, perhaps, before pale and flat, becomes red and turgid, the eyes gleam, and are inflamed; the pulſe becomes quick and hard; and from the exquiſite expectation of relief, ſhe looks wildly round on her attendants, loſing all reaſon and recollection; ſhe is frantic, with the moſt agonizing pain to which the human frame is ſubject. Now the occiput of the child begins to project with its wrinkled ſcalp through the external parts, but nature intends that this alſo ſhould dilate ſlowly; the ligaments and os coxigis reſiſt ſeveral throes, and direct the head forward under the pubes; at laſt, after ſeveral pains, it riſes with a half turn, and is delivered.

4th. The fourth ſtage, is the delivery of the body and ſhoulders; and,

5th. The fifth ſtage, is the delivery of the placenta. The placenta is expelled by a continuation of the ſame action of the womb, and is part of the natural proceſs. Firſt a flow of the liquor amnii and blood follows the child, and the woman lies for a time exhauſted; the extreme pain and excitement having ceaſed. The womb generally recovers its powers in about twenty minutes, and then there is grinding pain in the belly, and the placenta is detached and expelled, or is puſhed down into the vagina.

Thus we have ſketched, in the moſt ſuperficial manner, the progreſs of a natural labour, with a view merely to explain the general notion of the entire function of the womb, not with that minuteneſs which the accoucheur would look for in treating the ſubject. Let us, for an inſtant, attend to the ſtate of the umbilical cord, and the final contraction of the womb.

I have already obſerved, that while the membranes are unbroken, the child is ſafe, that is to ſay, there is no danger of the compreſſion of the umbilical cord; but when the membranes have burſt, and the waters are evacuated, the cord muſt ſuffer a degree of compreſſion betwixt the uterus and the child, and there is danger that the cord may fall down before the head, until the head has deſcended into the brim; as the uterus contracts, and as it were follows the child, the circulation through the placenta muſt become ſomewhat difficult, and the uſual function correſponding with that of the adult lungs impaired. This muſt be much more the caſe when the child is delivered, and the placenta remains in the contracted womb. No doubt nature intends by this, that the function of the placenta ſhall be gradually diminiſhed, and not ſuddenly cut off, that the child may feel occaſion for the play of the muſcles of reſpiration, and that the function of the lungs may, by degrees, take place of the function of the placenta. When the child is firſt delivered, the cord pulſates ſtrongly; when the child cries, it becomes feeble; at firſt, the child has ſtrong and irregular catches of the reſpiratory muſcles, but by and bye it breathes more regularly, and cries luſtily. At firſt the breathing only renders the pulſation of the cord feeble, but preſently the pulſation becomes ſo weak, that it is felt only near the umbilicus, and it ceaſes when the regular and interrupted breathing is eſtabliſhed, and the crying ceaſes.

The delivery of the child and placenta is followed by a conſiderable efflux of blood. But after this there continues a diſcharge from the uterus, which is called the lochia. It is like the exudation of blood from an extenſive wound, in as much as by the contraction of the veſſels from which it flows, it becomes ſerous in a few days, and ceaſes gradually like a hæmorrhagy.

This open diſcharge from the womb after delivery, is no doubt a proviſion againſt the conſequence which would naturally reſult from the ſudden and perfect obſtruction, and the activity of the uterine veſſels conſequent on delivery. By this diſcharge the activity of the veſſels is gradually relieved, and as it is a diſcharge taking place of the active ſtate of the womb, ſo the ſecretion of the milk in the breaſts, and the giving of ſuck, cauſes the diſcharge to ceaſe much ſooner than it would do if the mother were not the nurſe.

OF THE MAMMÆ.

In man and in children of both ſexes, there is no mark of the breaſt, but the little cutaneous papilla, or nipple. Theſe tubercles are, however, ſurrounded by a zone or diſk, of a browniſh red colour, the areola.

At puberty, as we have ſaid, the breaſt of the female becomes protuberant, and thoſe parts which were in miniature, and without action, quickly grow into a firm glandular maſs (ſpeaking anatomically). The ſhape, rotundity and firmneſs of the gland depends much upon the adipoſe membrane ſurrounding and interſecting the glandular body.

The glandular part itſelf is divided into little maſſes, which again conſiſt of ſmall granules. Theſe ſeveral ſubdiviſions of the glands are cloſely ſurrounded by membranes.

The lactiferous ducts are gathered together from theſe leſſer granules, and unite into 12 or 15 in number of a very conſiderable ſize, as they converge towards the root of the nipple. When milk is ſecreted, the glands are large, a remarkable diſtention of the ducts alſo takes place, for they are then become tortuous and varicoſe, and ſerve as reſervoirs of the milk. Where they paſs through the nipple, however, they are again contracted, and open by ſmall pores upon its ſurface. The nipple is of a ſpongy and elaſtic nature, and ſuffers a diſtenſion or erection. When the nipple is contracted, the lactiferous ducts muſt be compreſſed, and perhaps coiled together, ſo that the milk cannot flow, or flows with difficulty: but by the ſucking of the child, the nipple is diſtended, and the ducts elongated, ſo that the milk flows. There open upon the areola ſeveral ſuperficial or cutaneous glands, which pour out a diſcharge to defend it and the nipple from excoriation.

Of the arteries, veins, or lymphatics of the mammæ, we need not treat here.

We have many occaſions to obſerve the conſent and ſympathy which exiſt betwixt the womb and the breaſts. On the firſt period of the menſes, the breaſts are much diſtended. In many women at each return of the diſcharge, a degree of ſwelling and ſhooting pain is felt in them, and the enlargement and ſhooting pain in the breaſt, with the darker colour of the areola, is marked as the moſt prominent ſign of pregnancy: with the ceaſing of menſtruation, which is the ceſſation of the uſual excitement and action of the womb, the breaſts contract and are abſorbed. Any unuſual ſtimulus or irritation in the womb, as polypus, or cancers, or even prolapſus and excoriation, will affect the breaſts, cauſing them to enlarge and become painful.

When the function of the parts ceaſe, they ſeem to feel the want of the uſual excitement to correct action, and are apt to fall into diſeaſe; ſo it is at leaſt with the womb and mammæ, for at that period of life, when

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the ſyſtem is no longer able to ſupport and give nouriſhment to a child, and theſe parts ſubſide from their uſual action, they often become ſchirrous or cancerous, and terminate exiſtence by a tedious, painful, and loathſome diſeaſe.

PART THE FOURTH.

OF THE LYMPHATIC AND LACTEAL SYSTEMS OF VESSELS.

CHAP. I.

OF THE LYMPHATIC AND LACTEAL SYSTEMS OF VESSELS.

INTRODUCTORY VIEWS.

We have underſtood that the red blood circulates in the body, through veſſels (the arteries and veins) which have a direct communication at their extremities by inoſculation; that although theſe veſſels lie parallel to each other, and extend from the heart to the remoteſt part of the body, yet the blood is ſaid to paſs through the circulation, becauſe it is tranſmitted from the veins into the arteries through the medium of the heart; and from the extremities of the arteries directly into the veins, returning again to the centre. In this tranſmiſſion of the blood through continuous tubes, there is in the coats of the veſſels an alternation of contraction and relaxation which impels it forward. But beſides theſe arteries and veins carrying the red blood through the body, there are other veſſels more remote in their connection with what is generally called the circulating ſyſtem of veſſels.

SECTION I.

OF THE CAPILLARY VESSELS.

The capillary veſſels are thoſe extreme branches which are as minute as hairs; but this, though the literal, is not the general meaning of the term. By capillary veſſels is rather underſtood thoſe branches in which the changes are wrought from the blood, and which are either ſo minute as not to allow the promiſcuous flow of the blood, or poſſeſſed of ſuch a degree of irritability and appetency, as only to allow certain parts of that fluid to be tranſmitted.

It is proved that in the living body there is no exudation; but no ſooner is the animal dead, than the fluids exude from the veſſels, the ſecretions paſs through the coats of thoſe receptacles which formerly contained them, and the whole parts partake of an univerſal colour. From this ſimple fact, we are led to think that a property exiſts in the living fibre, which by contraction or ſome other property repels the fluids. Admitting this, it is very natural to ſuppoſe that the fibres, and more particularly the veſſels, have a diſcriminating property; ſo that the capillary texture of each organ poſſeſſes ſenſibility, which has its relations to the fluids paſſing through them, or to be ſecreted from them.

If we admit this, we may alſo forſee the explanation of the moſt puzzling phenomenon of inflammation. Inflammation is the effect of excitement: there is increaſed action of the arteries; and by the operation of the ſame cauſe, there is a deſtruction of the natural ſenſibilities of the capillary veſſels, ſo that they no longer are poſſeſſed of their diſtinguiſhing ſenſibility, and they admit the promiſcuous paſſage of the red blood: they become dilated by the action of the arteries, and viſibly diſtended with red blood. The effect is not merely the mechanical derangement of the particles of the blood. The chemical changes which take place in the extreme veſſels are diſordered, and the blood depoſits upon the extreme branches of the nervous ſyſtem an unuſual proportion of irritability; ſo that with the redneſs ariſing from the circulation of red blood through the hitherto pellucid veſſels, in parts not endowed with ſenſibility, there is acquired an unuſual ſenſibility, and the power of tranſmitting the ſenſation to the ſenſorium. Since we ſee that in an inflammatory ſtate the pellucid veins tranſmit red blood, and that this red blood muſt be ſupplied by the ſerous arteries; then it is proved that anſwering to the pellucid arteries (in their natural ſtate) there are pellucid veins. We ſhould acquieſce therefore in the opinion that ſuppoſes both the arteries and veins to have pellucid capillary branches anſwering to each other, collateral to the larger and more palpable anaſtomoſis of their red extremities. Theſe anaſtomoſing branches of the arteries and veins in which the red blood is ſeen to circulate, perpetuate the flow of the greater part of the blood back to the heart, while the ſeveral ſecretions are performed in the capillary veſſels *; but there is no reaſon to ſuppoſe that the fluids ſent from the arteries into theſe pellucid capillary veſſels are all poured out in form of ſecretions: part returns into the extremities of the circulating veins. The ſecreted fluids and ſolids are either carried away by ducts into their receptacles, or thrown out from the body: while thoſe fluids which are exuded on the cellular membrane and cavities are re-abſorbed by the ſyſtem of abſorbent lymphatics.

We ſay then that arteries terminate, firſt, in red veins; which is proved by the microſcope, and by mercurial and other injections; ſecondly, in glands; thirdly, in cells receiving red blood; fourthly, in lymphatic veins; fifthly, in exhalents, which pour their fluids into the cellular membrane, cavities, joints, &c. and which fluid is taken up by the valvular lymphatic abſorbents.

But theſe abſorbent veſſels, of which we are now to treat under the diviſion of lymphatics, do alſo perform a circulation, in as much as they convey back to the centre of the ſyſtem the fluids, which have been thrown out from the extremities of the arteries. But as theſe lymphatic veſſels are not continued from the extremities of the arteries as the red veins are, as they imbibe the fluids, which have been thrown out of the other ſyſtem; their fluid contents cannot be conveyed through them by the force of the heart and arteries, they muſt be peculiar in having powers within themſelves, firſt of abſorbing, and then of propelling their fluid onward to the heart.

This common property of abſorption in the lymphatics, abſorbents, and lacteals, and their being connected with the ſame trunk, occaſions their being conſidered as one ſyſtem of veſſels; when, in fact, looking upon the general œconomy of the living body, we find them miniſtering to very different purpoſes. The one branch of the ſyſtem, the lymphatics (as we have ſeen in the introduction to this volume), takes up the matter which has been ſecreted, and poured out from the arteries, (viz. all the ſolids and fluids of the body,) and conveys it again into the circulating ſyſtem. The lacteal veſſels on the contrary, are thoſe veſſels which opening upon the inner ſurface of the inteſtines receive into them the nutritious fluids, prepared by the organs of digeſtion, and ſuited to ſupply the inceſſant waſte and deſtruction of the ſolid and fluid parts of our frame, and which have been abſorbed and carried away by the lymphatics. Following this ſimple view, although the abſorbent ſyſtem be commonly divided into the thoracic duct, lymphatics, lacteals, and glandular apparatus attached to them, I ſhall throw the preſent ſection into the diviſions of the lymphatics and of the lacteals.

SECTION II.

OF THE LYMPHATIC SYSTEM IN PARTICULAR.

THE lymphatic veſſels are tubes whoſe coats are perfectly pellucid, having a remarkable power of contraction, which cauſes them to ſhrink, and diſappear, ſo as to render it difficult to demonſtrate them. Indeed they are only to be obſerved by an eye accuſtomed to the making of lymphatic injections. They are called LYMPHATICS, or DUCTUS AQUOSI, from their tranſmitting a fluid colourleſs as water. When they are diſtended with their fluids, they ſhow that they poſſeſs a very diſtinct character from the other circulating tubes. They are irregularly diſtended, knotty, and ſometimes like a chain of beads, or little irregular veſicles connected together. This irregularity is owing to their numerous valves, which are ſemilunar membranes, like thoſe of the veins, and hung acroſs their cavities, ſo as to catch and interrupt the refluent lymph. They ſay, in general, that in the ſpace of an inch the lymphatic veſſel has three or four pairs of valves. But this bears no certain proportion; for as theſe veſſels run where they are expoſed to occaſional compreſſion from the ſurrounding parts, or bear the weight of a high column of fluid, their valves are more frequent. The lymphatics are improperly called cylindrical tubes, ſince they are irregular from their valves branching and frequent communications. The coats of the lymphatic veſſels are the ſtrongeſt of any in the body; for although extremely thin and pellucid, they give reſiſtance to diſtention beyond a certain point, and bear a column of mercury which would burſt through the valves of veins, and tear the coats of arteries. If there be a muſcular coat, and no one ever denied the muſcularity of the lymphatics, then we may reckon three coats: Firſt, The inner coat, which is the continuation of the inner tunic of the veins, as may be obſerved in the opening of the thoracic duct into the left ſubclavian and left jugular veins. It is ſmooth and poliſhed, forms duplicatures or valves, and prevents the tranſudation of their fluids: it is connected by cellular membrane to the middle coat. Secondly, The muſcular or middle coat, which conſiſts chiefly of muſcular fibres, which, according to Sheldon, run in every poſſible direction, though the greater number take the circular direction. And, laſtly, the outer coat, which is connected with the general inveſting cellular membrane. As the inner coat muſt chiefly form the valves, and as the valves poſſeſs ſo wonderful a power of reſiſting the column of mercury, I ſhould hold that the inner coat is that on which the ſtrength and reſiſtance to diſtention of the lymphatics depends, though it has been ſaid that it is to the outer coat that they owe this property. The muſcularity of theſe veſſels is rather inferred than proved : it is inferred from the unaſſiſted action which they have to perform in preſſing the abſorbed fluids onward to the heart. Nevertheleſs we ſometimes ſee the lymphatics of the lower extremities of a colour ſo red and fleſhy, that we may ſay their muſcularity is demonſtrable.

The lymphatics ſeem to poſſeſs little elaſticity; when they are blown into, they riſe with the ſlighteſt force, and remain diſtended, although the paſſage of the air forward be uninterrupted : whereas, had they conſiderable elaſticity, they would contract and diſappear. Indeed, when empty, in the dead body they may be rather ſaid to be collapſed than contracted.—Although the lymphatics can be diſtended with the ſlighteſt inflations, yet when diſtended, as we have already obſerved, they firmly reſiſt further dilatation. This is a quality neceſſary to their valvular ſtructure, for if they were elaſtic beyond this degree of dilatation, the caliber of the veſſel would be occaſionally ſo enlarged as to render the valves incapable of meeting, and of preventing the retrograde movement of the fluids.

SECTION III.

OF THE GLANDS OF THE ABSORBENT SYSTEM.

Every where throughout the body and viſcera betwixt the extreme branches of the abſorbent ſyſtem and the trunk, glandular bodies are interpoſed. Though of various forms they are generally of an oval ſhape, and they vary in ſize from the twentieth part of an inch to a full inch in diameter. Sometimes they are ſegregated,—ſometimes accumulated and cluſtered together. The colour of thoſe bodies is various in the ſeveral parts of the body: in young animals they are redder, and become pale only with age. They are redder and ſtronger in the outer parts of the body, as in the thigh, axilla, &c. leſs ſo within the abdomen and thorax. 2. The latter will not bear ſo high a column of mercury as the former. The meſenteric glands are ſaid totally to diſappear in old age*.

It would appear that the glands of this ſyſtem are of more importance to young animals than to adults. In the fœtus and in children the lacteal and lymphatic glands are exceedingly numerous; but they ſhrink or diſappear with old age. In the fœtus, indeed, they can be of no very eſſential uſe; they are then rather in a ſtate of preparation for the actions neceſſary in infancy and youth. It is then alſo that they are moſt liable to diſeaſe, and ſeem more irritable and ready to inflame, eſpecially in ſuperficial ſituations. About the age of fourteen or fifteen this diſpoſition is changed, which is commonly ſaid to proceed from the increaſed vigour of the conſtitution, and the change which then takes place on the organs of generation. It is rather to be attributed, however, to the diminution of irritability and activity of their veſſels in verging to the adult ſtate, which is marked by their comparatively leſs ſize, and ſmaller degree of vaſcularity. We may further obſerve that the lymphatic glands, even in the ſcrophulous diſeaſes, are ſeldom primarily affected: that they partake of diſeaſed action from the ſurface, or from an affection of the inteſtines, or from the abſorption of matter. The ſtructure of theſe glands has not been ſatisfactorily inveſtigated; or the inquiry is attended with inſurmountable difficulties. Some anatomiſts have ſaid, that they conſiſted of the convoluted abſorbent veſſels; others that they are of a cellular ſtructure. When they affirm that theſe cells are totally diſtinct from the lymphatic veſſels, it is not ſo eaſy to underſtand them: for cells communicating with each other, and into which the lymphatic veſſels enter, are very much the ſame with a ſeries of convoluted, varicoſe, and irregularly dilated veſſels. If we could diſſect this ſeries of cells, as Haller did the veſiculæ ſeminales, we ſhould have repreſented to us the appearance of a convoluted varicoſe veſſel.

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* By Ruyſch, Morgagni, Haller, Sheldon.

There is a coat of cellular membrane which ſurrounds the glands. This coat is pervaded by a peculiar fluid which has given riſe to ſome ſpeculation. It is obſerved chiefly in young animals, and is for the moſt part, though not always, white and milky, and in the glands of the lungs it is of a blackiſh colour. This is the fluid which having globules in it, was ſuppoſed by Mr. Hewſon to be the firſt ſtage of the formation of the red globules of the blood. It is diſtinct from the abſorbed fluids, and is a ſecretion from the arteries. Phyſiologiſts have not determined the nature or uſe of this fluid.

At preſent there ſeems no better hypotheſis to be offered regarding the uſe of the lymphatic and lacteal glands, than that they ſerve to check, controul, and meaſure the flow of the abſorbed fluids into the maſs of the blood: without them it appears to me probable that at one time the lymph returning from the body, or at another time the chyle, might flow too rapidly, and in a diſproportioned quantity into the veins and heart. But by the check which the glands impoſe upon this flow, giving a remora and ſerving as receptacles of the abſorbed fluids, thoſe fluids are poured with a more uniform and conſtant flow upon the heart.

SECTION IV.

ORIGIN OF THE LYMPHATICS, AND OF THE DOCTRINES OF ABSORPTION.

THE lymphatics, forming a ſyſtem of abſorbents, we might ſay, in general, that they take up all the fluids which have been thrown out upon the ſurfaces of the body. Thus they ariſe from the ſurface of the ſkin; from the ſurface of the cavities and viſcera covered by the pleura and peritoneum; from the cells of the interſtitial and adipoſe membrane, &c. This is the ſimple uſe aſſigned to this ſyſtem of veſſels: but whether they are the only ſyſtem of abſorbents; whether they carry away all the parts of the ſyſtem, fluids and ſolids; whether they abſorb the muſcles, membranes, bones, tendons, &c. of which the ſolid body conſiſts, is a queſtion requiring ſevere examination. It cannot be denied that although the ſyſtem and doctrines of abſorption be the moſt beautiful and intereſting, and apparently the ſimpleſt in the whole œconomy, yet it is founded on very few facts, while there is much doctrine tacitly acknowledged, which ſeems in ſymmetry with the facts and the laws of the œconomy, but which is not founded in abſolute proof. We ſhall firſt examine the proofs of the lymphatics being the veſſels which abſorb the fluids of the cavities and ſurfaces of the body. The animal machine univerſally partakes of motion. A principal proviſion for this mobility of parts, is the looſeneſs of the cellular membrane which every where pervades the body, and ſupports the veſſels and connects the ſeveral parts. This interſtitial membrane is elaſtic, and being cellular, to allow of motion, its ſurface is bedewed with ſerous exudation. This fluid is perpetually paſſing from the extremities or ſides of the lymphatic arteries or capillaries, into the cellular membrane, and upon all the cavities of the body. The fluid extravaſated is called lymph, and ſome have ſuppoſed that it paſſes through inorganized pores, an expreſſion that is not very intelligible; but if by this is meant (as has ſometimes been explained) "accidental pores" in the ſides of the veſſels, it is a ſuppoſition quite improbable and unlikely *. The pores

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* Dr. Hunter ſupported this opinion (Commentaries p. 40,) viz. "that the fluids of cavities were collected by tranſudation, and not thrown out by exhalents;" an opinion which could only have ariſen from not correcting the ideas received in making injections in the dead body by the phenomena of the living ſyſtem. See *Hewſon on the Lymphatic Syſtem*, chap. viii. where the opinion of inorganical filtering is ſucceſsfully combated.—See alſo Cruickſhanks.

pores or veſſels from which this fluid exudes are called exhalent; and their action is no doubt as completely ſecretion as that which produces the fluids, which in our wiſdom we call more perfect ſecretions.

That the lymphatics take up the fluids thrown out in the cavities of the body, as the abdomen, thorax, pericardium, &c. there is what nearly amounts to an abſolute proof, in comparing the fluids of thoſe cavities with that contained in the veſſels, for by the experiments of Hewſon it is found that if the fluid moiſtening the cavities be collected, it will form a jelly when expoſed to the air, as the coagulable lymphatic does. Again, if a lymphatic veſſel be tied up in a living animal, and then opened ſo as to allow the fluid to flow into a cup, it will alſo form a jelly like the coagulable lymph*. The fluid of cavities alters in animals diſeaſed; ſometimes retaining its coagulability, and even acquiring ſtronger powers; ſometimes loſing it altogether. But what is moſt eſſential to our preſent purpoſe, it has been obſerved, that whatever change takes place in the fluids of the cavities, the ſame is found to have taken place in the lymphatics.

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* But, by diſeaſe, the fluids in the cavities and cellular membrane is altered. In dropſy, for example, the fluid of the abdomen loſes the property of coagulating on mere expoſure; it comes to reſemble more the ſerum of the blood: this were ſufficient proof that the collection is not owing merely to the diminiſhed abſorption, but that there is a change of action in the veſſels of the peritoneum, pleura, pericardium, &c. An inflammatory action of the veſſels will throw out a fluid more coagulable, and which, in a high degree of action, will form a film of coagulable lymph or even pus on the ſurface. But in a ſtate the reverſe of inflammation, ſuch for example as the debility following inflammation, a ſerous effuſion will be poured out, having little tendency to coagulate.

But the ſtudent naturally aſks, how is the lymph taken into the lymphatic veſſels; and here it muſt be confeſſed, there is too much field for conjecture.

It was thought formerly that the lymphatic arteries terminated in ſmall pellucid veins: theſe veins carrying only the thinner, and refuſing the red part of the blood, were called lymphatics. When the anatomiſt threw in his minute injection, and ſaw the coloured fluid return by the red veins, and the colourleſs fluid return by the lymphatics *, it was held as a ſufficient proof of the accuracy of the preconceived notion, and tallied with obſervations of Leewenhoeck, and the theory of Boerhaave. See Introduction to Vol. III. When, however, anatomiſts more carefully examined the ſtate of parts, they found that the lymphatics were not filled, unleſs the cellular membrane was previouſly injected by the extravaſation of the fluid from the blood veſſels. Finding that this alleged experiment was really no proof of the anaſtomoſis, and direct communication betwixt the extreme arteries and lymphatics, they conceived that it was a proof that theſe lymphatics took their riſe from the cellular interſtitial texture. Then injecting with mercury, they found that when the veſſels burſt, and the column ſuddenly deſcended, and the cellular membrane was filled, the mercury was ſeen to riſe in the lymphatics. Following up this, they blew air, or injected various

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* It was probably Nuck who firſt injected the lymphatics from the arteries.

fluids directly into the cellular membrane, and injected the lymphatics. Thus by an error, by an accidental effect of their injection, the minds of Dr. Hunter and Monro were opened to a freer diſcuſſion of the received opinions and approved authorities. Soon, however, it was underſtood by thoſe converſant with anatomy, that theſe accidental injections of the lymphatics did not prove the lymphatics to take their origin either from the cells or from the extreme arteries; but already this good effect, at leaſt, was produced, that men's minds were excited to inquire after new facts and trains of obſervation. It was now recollected, that a ſtrict analogy and correſpondence ſubſiſted betwixt the lymphatics and lacteals; the proofs of the lacteals being abſorbents, were recalled to memory; new proofs of their being the ſole abſorbents of the inteſtines were brought forward; the nature of the fluids effuſed into the various cavities and cells of the body was attended to; and the conviction followed, that the moſt eſſential uſe of the lymphatic veſſels was to ſerve as a ſyſtem of abſorbents, to take up the extravaſated fluids. They reflected that to diſtend the inteſtines with injection would never fill the lacteals; and were convinced that the injection of the lymphatics could not be ſuppoſed to be through the proper abſorbing mouths of theſe veſſels opening upon the cells; but rather that the injection had entered the veſſels by the rupture of their extreme branches. Thus the *theory* of the lymphatics being a ſyſtem of abſorbents, came to reſt on analogy, and the obſervation of the phenomena of the living body.

The chief proof of the lymphatic abſorption has been derived from the manner in which the venereal virus is received into the ſyſtem. Venereal matter being allowed to lodge upon the delicate ſkin of the glans penis or preputium, cauſes an ulcer there. The matter of this ulcer is abſorbed by the lymphatic of the part; an inflamed line is ſometimes to be traced into the groin; and the lymphatic gland of the groin receiving this abſorbed matter, inflames and forms the bubo. Here, then, is a proof that the red veins do not abſorb, and that lymphatics do: elſe why are they inflamed,—and why are the lymphatic glands inflamed to ſuppuration.

We muſt obſerve, however, that this is by no means an abſolute proof of abſorption; nor is there here unequivocal evidence of venereal matter having been abſorbed. Although, therefore, we believe in the general ſyſtem, we may hazard theſe queries:—If this matter is abſorbed, why is there no infection without ulcer (chancre) of the glands? If this ulcer be produced by abſorption, how comes it that the conſtitution is not infected by the firſt abſorption of the matter, and before it has formed an ulcer? Is it not probable that the irritation of the venereal matter, lodging on this vaſcular ſurface, and without being abſorbed, cauſes a peculiar inflammation, the tendency of which is to form a puſtule, and to produce matter ſimilar to that which originally infected the part with the ſpecific and peculiar action? Again it will be ſaid, however the venereal puſtule was originally produced, it appears evident that the abſorption of this matter, the conveying of it along the lymphatic, inflames the veſſel, and the next lymphatic gland into which it enters, receiving the venereal matter, inflames and ſuppurates, &c. But again, I chooſe to ſay, with every ſhow of likelihood, that neither is this a proof of abſorption; but that the lymphatic veſſel being very irritable, and always receiving its ſtimulus to action from its extremities, it has partaken of the venereal inflammation; that this inflammation has been propagated to the gland; that, the gland being formed of the convoluted lymphatic veſſels, the effect of this inflammatory action is then accumulated to ſo great a degree as to deſtroy the function of the gland and lead to ſuppuration *. And further, that the diſeaſe is received into the conſtitution only in conſequence of the ſyſtem at large partaking of the irritation (a word which but imperfectly expreſſes the change) of the local action of veſſels. Matter might be abſorbed and taken into the conſtitution, and the diſeaſe propagated according to the common explanation; but, according to that offered here, there muſt be a primary and local diſeaſe, from which the general affection is propagated. If we are to take the inflammation and hardening of the lymphatics and axillary glands as a ſymptom of abſorption from a diſeaſed mamma, we muſt acknowledge the ſame proof in evidence of the veins abſorbing: for although the lymphatics are more active, and their activity depends on the ſtate of their origins and extreme branches,

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* If a chancre be indolent, although matter be formed in it, no bubo will be produced: but if the ſurgeon applies ſome corroſive dreſſing, which, inſtead of entirely deſtroying the diſeaſed ſpot, inflames it; then will the gland in the groin ſympathize and riſe into a bubo.

more irritable, more vaſcular (I will venture to ſay), and more liable to inflammation than the veins; yet are the veins affected in a way that would as unequivocally prove them to be abſorbents, for we ſee how they enlarge around a diſeaſed breaſt, become prominent and hard, and loſe their ſoftneſs and elaſticity. But, as we would not ſay that this is a proof of abſorption by the veins, neither is the proof unequivocal that there is abſorption by the lymphatics. Again, a ſuppurating ſtump, with bad inflammation, will cauſe inflammation of the lymphatics, and ſuppuration in the glands of the groin*; a proof of abſorption of the matter of the ſtump: but we do not find that from ſuch a ſtump the veins aſcend, inflamed and ſuppurating, while ſometimes a chain of abceſſes is formed for a conſiderable extent. This, we can have no doubt, is the effect of the inflammation continued along the veſſel; and is not the inflammation produced preciſely in the ſame way in the lymphatic?

I found my opinion of the lymphatics being abſorbents,—firſt, on the circumſtance that their ſtructure is adapted to this action; ſecondly, on the analogy between them and the lacteals, in which abſorption is proved; thirdly and laſtly, upon their continuing to receive and tranſmit their fluids, after the heart and arteries have ceaſed to beat, and the red blood to circulate: for then how can they act, but by their own powers? How can they receive fluids, but by abſorption? Finally, this phenomenon ſhows in the lymphatics, a greater degree of irritability, and ſtronger principle of activity and tenacity of life, than actuates any other ſet of veſſels.

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* See Hunter's Commentaries.

OF THE ABSORPTION OF SOLIDS.

ON examining the works which within the laſt forty years have contributed to throw light on this ſubject, we at once acknowledge how neceſſary it is for that part of a ſyſtematic book of anatomy, which profeſſes to treat of abſorption, to take the form of a critical inquiry. When the abſorption of the fluids of the cellular ſubſtance, or in the cavities, was univerſally aſſented to, phyſiologiſts did not make ſufficient diſtinction betwixt the abſorption of the fluid thrown out of the influence of the circulating veſſels, and that matter which continued to be involved in the membranes and veſſels, and which formed the ſolid part of our frame. It will readily be allowed that the fluid thrown out upon the ſurfaces of the body and in the cells, might be abſorbed without inferring that every part of the body, ſolids and fluids, were alſo taken up by the lymphatic abſorbent veſſels. But phyſiologiſts obſerving that the ſolid parts of the body were ſuffering perpetual change; that the whole body and the veſſels themſelves were formed, decompoſed, and carried away; they heſitated not to attribute this to the depoſition from the arteries, and the abſorption by the lymphatics. This alternate deſtruction and renovation of parts, the perpetual change which the whole body ſuffers, has been univerſally acknowledged and attributed in part to the operation of the lymphatic ſyſtem, without any other proof than a ſlight analogy.

The interſtitial fluids, and the fluid in the cavities, is imbibed by the abſorbing mouths of the lymphatics on the ſurface of the membranes; but where is the analogy between this and the deſtruction of ſolid parts? It has been ſaid that the abſorbents eat down the ſolids, and nibble like the mouth of a worm! a conjecture, the falſity of which is equal to its apparent abſurdity. The ſolids are raiſed by the agency of the veſſels on the chemical affinities of the circulating fluids. They muſt be reſolved by their decompoſition, reducing them again to the ſtate of fluids; or the ſecreting veſſels throw out fluids which diſſolve them: an operation anterior to their abſorption. From the comparative ſimplicity of the fluids of the circulating veſſels, and that in the abſorbents, we are authorized to conclude, that as from the blood the ſeveral ſecretions, ſolids, and fluids are formed; theſe fluids, before they are again taken into the active ſyſtem of veſſels, are reſolved into their original ſimple and conſtituent parts. Thus we are not to look for the matter of the component parts of the body in the abſorbing ſyſtem of veſſels more than in the blood, from which theſe parts were originally formed.

Upon this ſubject I conceive, that the abſorption of the ſolids depends but in a limited degree on the agency of the lymphatics; and that there is a neceſſary change in the aggregation of the matter previous to the abſorption by the mouths of the lymphatic veſſels.

EXAMINATION OF SOME OPINIONS OF MR. HUNTER ON THE SUBJECT OF ABSORPTION OF SOLIDS.

MR. HUNTER ſays that his conception of the matter is, that nature leaves little to chance; and that the whole operation of abſorption is performed by an action in the mouths of the abſorbents. Phyſiologiſts have laboured, he obſerves, to explain abſorption on the principle of capillary attraction, becauſe it was familiar; but as they were ſtill under the neceſſity of ſuppoſing action in the veſſels after the matter was abſorbed, they might as well have carried this action to the mouths of theſe veſſels.

One never could have ventured to ſuppoſe the extravagant concluſion to which this idea, once entertained, has led Mr. Hunter.—He proceeds to conſider the many kinds of ſolids the lymphatics have to carry away, and the variety of mouths in different animals, ſuited to the great variety of ſubſtances they have to work upon, and then draws the concluſion, or leaves his reader to do ſo; that not only are the mouths of the lymphatics calculated to abſorb fluids; not only do they carry away the ſolids, but each veſſel, according to the hardneſs and toughneſs of the material upon which it has to operate, has a mouth adapted for the work. Here we do not ſee the genius of Hunter, but a poverty of imagination.

Mr. Hunter takes the merit of a new doctrine relating to abſorption.—He admits that oil, fat, and earth of bones had always been conſidered as ſubject to abſorption; and that ſome other parts of the body liable to waſte had been ſuppoſed to ſuffer by abſorption; but that any ſolid part ſhould be abſorbed, he ſuppoſes to be entirely a new doctrine.—Now, I think we may venture to affirm, that not only was it known that ſolid parts of the body were taken away during life; but that phyſiologiſts knew each and every part of the living body to be undergoing a perpetual decay and renovation. Nay, we may venture further to ſay, that Mr. Hunter did not comprehend, in its full extent, the relation in which the ſecreting and abſorbing veſſels ſtand to each other. He is fond of calling the abſorbents, modellers,—“ modellers of the original conſtruction of the body,”—“ modellers of the form of the body while growing.” No doubt he underſtood that ſuch terms from their novelty would be acceptable to minds incapable of real conviction, or of receiving or appreciating a new fact or idea. Mr. Hunter could contemplate no change in the body during growth, decay, or diſeaſe, where there was an alteration of form or quantity of matter, without attributing it to the “ modelling abſorption.”—A bone cannot be removed without abſorption; nor a part which is uſeleſs to the œconomy (as the alveoli of the teeth, the ductus arterioſus, the membrana pupillaris, the thymus gland) diminiſhed in ſize or totally carried away, without the abſorbents being in action. This is undoubtedly true; but in regard to the manner in which it is performed we cannot agree with Mr. Hunter. When it becomes neceſſary that ſome part ſhould be removed, it is evident that nature, in order to effect this, muſt not only confer a new activity on the abſorbents, but muſt throw the part to be abſorbed into ſuch a ſtate as to yield to this operation. This is the only animal power capable of producing ſuch effects; and like all other operations of the machine, it ariſes from *ſtimulus* or irritation &c. Now, this appears to be the fundamental error of Mr. Hunter's doctrine. I conceive that the abſorption of parts in the natural action of health or in diſeaſe, is not owing to increaſed ſtimulus, but often to a diminution of it.

Does it not ſtrike us forcibly that when a gland ſwells, and leeches and bliſters are applied, and it ſubſides, there can be no means of exciting abſorption; that when preſſure is made on a part, and that part is abſorbed, this is a ſtrange way of ſtimulating? Or when we bleed, is it not odd that this ſhould give new power to the lymphatic ſyſtem? for theſe are the means of giving a counter irritation, and of ſuppreſſing action.

Mr. Hunter has given to the lymphatics not only the grovelling qualities of animals, as eating; but the higher attributes of intellect. They do nothing without forethought and intention; when they abſorb, it is becauſe they have found the parts uſeleſs in the œconomy. He has carried this notion ſo far, that he does not only ſpeak of the abſorption of the thymus gland, membrana pupillaris, alveoli of the teeth, &c.; but of the body in fever as a conſequence of its becoming uſeleſs when under diſeaſe!—The following may perhaps appear to be the more natural ſuppoſition:

In a living body we may obſerve the agency of the nervous, vaſcular, and abſorbing ſyſtems: and the phenomena of life are not to be attributed to any one, but to the whole of theſe. We muſt alſo obſerve, that life, or the mutual action of parts producing the phenomena of life, is proceeding from excitement, and as in the whole ſyſtem, ſo in the individual parts of the body, the healthy action depends on the influence of this excitement to action. The tendency of the growth of the body to peculiar forms, and the increaſe of parts in diſeaſe are produced by it. It acts upon the vaſcular ſyſtem in diſeaſe, by producing increaſed action and ſecretion; as a muſcle, in the uſe of frequent and ſtrong action, will become more fleſhy and vaſcular; as a gland, will be excited to greater action and more profuſe diſcharge, whilſt it enlarges and ſwells up. When a part enlarges in conſequence of the ſtimulus to increaſed action, either ariſing from the natural law of the conſtitution or from diſeaſe, it proceeds from the ſecreting veſſels preponderating over the abſorbing veſſels. There is a depoſition of matter which the latter are unable to take away. But diminiſh this action of the arteries, or take away their excitement, or cauſe an excitement of ſome neighbouring part, and thereby ſubdue their action, relieve them of their fulneſs, and the abſorbents regain their proportioned actions, and the part ſubſides. The parts of the body, which, in the natural changes from youth to age, are abſorbed and carried away, are thoſe in which there is no longer the ſtimulus to vigorous action, and of courſe the lymphatics preponderate over the power of the ſecreting veſſels, and the part gradually diminiſhes, loſes its apparent vaſcularity, loſes its redneſs, and is at laſt totally abſorbed. And as the tooth of a child lies long hid under the jaw, where it partakes of the ſtimulus to the action of its veſſels, grows, and riſes up, and the alveoli, partaking of this natural excitement, alſo form around it; ſo when the tooth decays and falls out, the alveoli will alſo decay and be abſorbed; becauſe the moment theſe veſſels have ceaſed to partake of the increaſed action, their abſorbents, though acting with no greater powers than formerly, do yet ſo preponderate, that a gradual waſting is the conſequence. Thus we have to conſider not the action of the abſorbents merely, but the relation which their action has to that of the arteries.

I ſhould conclude that a part which has ceaſed to be of uſe in the œconomy and is abſorbed, has not been carried away by the ſtimulus applied to the modelling lymphatics; but in conſequence of a want of the uſual excitement of the parts to action, and of the conſequent preponderance of the action of the lymphatics; not by an increaſe of their action, but by a greater uniformity of action, leſs dependent on the ſtate of excitement of the part. This more uniform ſtate of action, or leſſer degree of dependence on excitement, will not be denied when we ſee them continuing their action after the death of the animal, and after the other phenomena of life have ceaſed. As to the abſorption of the body in general from diſeaſe, as in fever, it appears to be ſimply the effect of the continued abſorption, while neither the organs for digeſting and aſſimulating new matter, nor the vaſcular ſyſtem for conveying the fluids, are in a ſtate to miniſter to the wants of the ſyſtem, but ſuffer under an unuſual irritation, which diſorders their function.

As to preſſure cauſing abſorption and producing the waſting of parts, I cannot agree with Mr. Hunter in ſuppoſing that the lymphatics are here excited to action; but ſhould rather infer that the nerves of the parts being benumbed, and the action of the arteries ſuppreſſed, the lymphatics continue to do their office, while the arteries are prevented from depoſiting new matter.—For example, when we ſee a curvature of the ſpine, from a habitual inclination of the body to one ſide, and conſequently greater preſſure on the one ſide of the bodies of the vertebra:

it is natural, at firſt ſight, to ſay, ſince the one ſide of the vertebra is of its natural depth, and the other diminiſhed, that the ſide which is deep has remained, but the other ſide has been abſorbed; but, when we inquire a little deeper into the phenomenon, which has taken place, we recollect that the matter of bone is undergoing a perpetual change, and that the matter of both ſides of the vertebra is changed; we ſee that the preſſure may not have excited the veſſels to greater action ſo as to cauſe abſorption; but that the preſſure has prevented the depoſition of new matter, when the old was taken away in the natural rotine of the ſyſtem.

Mr. Hunter has aſſigned five cauſes of abſorption, which I conceive may be very naturally reſolved into one.—Theſe are, 1, parts being preſſed; 2, parts being irritated; 3, parts being weakened; 4, parts being rendered uſeleſs; 5, parts becoming dead: of the firſt we have already ſpoken; the ſecond I ſhould deny, unleſs when it reſolves into the third; for irritation does not cauſe abſorption, unleſs when it is to an extent ſufficient to deſtroy the natural action and weaken the part. The third and fourth come under the effect of the loſs of the natural and accuſtomed ſtimulus to action in the arterial ſyſtem, which of courſe gives a preponderance to the abſorbents: of the fifth we can have nothing to add illuſtrative of the living ſyſtem.

CHAP. II.

OF THE COURSE OF THE LYMPHATICS.

THE lymphatics, in their courſe and relation to the faſcia and muſcles of the extremities, bear a great analogy to the veins; for there are two ſets or grand diviſions,—the DEEP LYMPHATICS which accompany the arteries in their branchings amongſt the muſcles; and the SUPERFICIAL ſet which accompany the external veins.

SECTION I.

OF THE FOOT, LEG, AND THIGH. Even in the toes the ſame deſtinction of the origins of the lymphatics may be obſerved, as in the limb. For while a plexus covers the toes ſuperficially, and runs up upon the foot with the veins, deeper branches accompany the arteries on the ſide of the toes. When we obſerve the courſe and origins of the greater and leſſer ſaphena vein, we cannot fail to underſtand the courſe of the ſeveral ſets or diviſions of the lymphatics of the foot and legs.

From the toes, dorſum, and edges of the foot, the lymphatics climb up the leg in four claſſes. 1. One takes a courſe from the root of the great toe and inſide of the foot, over the tendons of the great toe and tibialis anticus tendon. It then paſſes on the inſide of the tendon of the tibialis anticus muſcle, and before the head of the tibia, following the principal branch of the great ſaphena vein; and then continues its courſe in company with the ſaphena to the inſide of the knee. 2. There is at the ſame time a conſiderable number of lymphatics, taking their origin from nearly the ſame place, viz. the inſide of the foot, and before the inner ancle; but they take a different courſe on the leg from the laſt claſs; for they paſs behind the lower head of the tibia: they now attach themſelves to ſome branch of the ſaphena vein, and join the former ſet on the inſide of the knee. From this they aſcend ſuperficially above the faſcia to the glands of the groin. 3. From the outſide of the foot there aſcend ſeveral lymphatics; a diviſion of which paſſes before the outer ancle and acroſs the tibia to join the lymphatics, paraſites of the great ſaphena vein, and here they ſometimes form plexus and contortions; others turn in behind the outer ancle, and join the branches accompanying the leſſer ſaphena.

The lymphatics which turn round behind the outer ancle paſs on the outſide of the tendo achillis; and accompanying the leſſer ſaphena vein, ſink into the popliteal hollow. Here they unite with the lymphatics which have accompanied the ſeveral arteries of the leg and foot, and particularly the poſterior tibial artery.

Popliteal glands. The glands of the ham-ſtring cavity are generally three in number, and very ſmall. They receive the lymphatics, which paſs with the internal tibial artery and with the leſſer ſaphena, and they of courſe ſwell and become inflamed in conſequence of ſores on the calf of the leg, outſide of the foot, and ſole of the foot.

From the popliteal glands there aſcend two large lymphatics, which accompany the popliteal artery and venæ comites, and aſcend with the latter through the adductor magnus to the fore part of the thigh. They run irregularly, or form a kind of network round the great veſſels. On the fore part of the thigh, and ſtill deep, they (or at leaſt ſome of the principal trunks) enter the lower and deep inguinal glands, or emerging, they paſs into the outward glands of the groin. Sometimes theſe deep lymphatics, inſtead of being accumulated into larger trunks, divide into many branches, and only unite in the glands of the groin.

Inguinal glands. The inguinal glands are in number from five to ten; they lie involved in cellular membrane on the outſide of the femoral ligament. Some of them are ſuperficial and moveable under the integuments; ſome involved in the laminæ of the faſcia, deſcending from the abdominal muſcles; ſome are cloſe on the femoral artery and vein, and under the faſcia. Nearer to the pubes may be obſerved a diviſion of theſe glands which belong to the lymphatics of the penis, perineum, &c.

The greater cluſter of glands on the top of the thigh becomes affected from diſeaſe of the integuments on the fore part and inſide of the thigh and leg; and of that part of the foot where the great ſaphena vein commences; nay, further, the inguinal glands ſwell from ſores of the buttocks, about the anus and private parts. They will even ſwell from diſeaſe of the teſticle; but this only by ſympathy.

Lymphatics of the parts of generation in both sexes. From the penis there run backwards two ſets of lymphatics: ſuperficial ones, which take a courſe to the groin; and deeper ones, which take a courſe along the arteries of the penis into the pelvis, or under the arch of the pubis. The ſuperficial lymphatics are the cutaneous veſſels, and take their origin from the prepuce, and it is theſe which, either abſorbing the venereal matter of chancre, or ſympathizing with the venereal action, form ſometimes an inflamed line along the penis, and cauſe the buboe in the groin. But as there are two ſets of lymphatics, the chancre may be in a place where the deep-ſeated veſſels are the abſorbents, and conſequently the conſtitution is contaminated without any buboe in the groin; and indeed it has been obſerved, that a venereal ulcer of the prepuce will, in general, produce buboe, when an ulcer of the glands will not *. When the tract of the matter is through the deep lymphatics which enter the pelvis from below, the gland through which the veſſels paſs, is not inflamed to form a buboe; neither do the lymphatic glands within the ligament of the thigh inflame to the extent of forming a buboe, either from chancre or from buboe in the groin. This, ſays a celebrated anatomiſt, Mr. Cruickſhanks, is very fortunate; for if the external iliac glands, like the inguinal glands, ſhould ſuppurate, they could not be opened by the lancet, they muſt be left to themſelves; they might burſt; the pus might fall into the cavity of the abdomen; might produce peritoneal inflammation; and might probably deſtroy the patient. Now, there appears no reaſon to dread any ſuch cataſtrophe. The matter of theſe glands would form an abceſs, which,

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* Cruickſhanks, page 138.

like other abceſſes in the track of theſe veſſels, would fall down upon the thigh. The fact, however, is curious; that when the lymphatics diſeaſed enter one ſet of glands, there will be no buboe; when they take a courſe to the other, they inflame and ſuppurate. This I believe may be explained, from conſidering the poſiton of the inguinal glands, as being immediately under the ſkin: for experience ſhows that a part near the ſurface will inflame and proceed to ſuppuration much more readily than a part deep ſeated, though ſuffering from the ſame degree of excitement.

In the external parts of woman (by Mr. Cruickſhanks's obſervation) there are alſo two ſets of lymphatics. Thoſe near the clitoris paſs up in a direction to the ring; and thoſe from the lower part of the vulva and perineum to the glands of the groin.

LYMPHATICS AND GLANDS WITHIN THE LIGAMENT OF THE THIGH. The vaſa efferentia of the inguinal glands are in number from two to ſix. The deep lymphatics which accompany the femoral vein and artery, lying under the cellular membrane, paſs under the ligament, and ſoon form a large net-work of veſſels accompanying the iliac veſſels, in which they are joined by the branches of lymphatics from the ſuperficial glands; ſometimes the trunks accompanying the great veſſels of the thigh paſs into a gland, immediately within the ligament; ſometimes one or two of them only enter into the glands high in the loins; nay, ſometimes a large veſſel paſſes on directly to the thoracic duct.

From ſix to eight or ten glands are ſeated in the tract of the external iliac veſſels, under the name of EXTERNAL ILIAC GLANDS. And upon the inſide of the brim of the pelvis, and on the hypogaſtric veſſels, the glands are called the INTERNAL ILIAC GLANDS. In proportion to the frequency of diſeaſe in the pelvis, theſe external iliac glands, being in the tract of the lymphatics of the private parts and rectum, &c. are particularly ſubject to diſeaſe. Thoſe glands alſo which are called SACRAL GLANDS, as lying on the meſo-rectum, and in the hollow of the ſacrum, have been obſerved to be often diſeaſed. On the pſoas muſcle, and on the loins it is impoſſible to trace the veſſels as ſingle trunks; we may obſerve that one net-work of veſſels aſcends upon each pſoas muſcle from the thigh; that there it is joined by the lymphatics of the pelvis. Theſe veſſels are in a manner united by thoſe which cover the prominency of the ſacrum, and paſs under the bifurcation of the aorta. The two GREAT LUMBAR plexus of lymphatics continuing their aſcent, many of the veſſels enter into the lumbar glands; and on the loins they are joined by the abſorbents of the teſticle. By the union of the lymphatics aſcending from the right and left ſide, with ſeveral large trunks of the lacteals from the root of the meſentery, the thoracic duct is formed on the third and fourth vertebra of the loins.

OF THE LYMPHATICS OF THE ARM.

IN the arm, as in the leg and thigh, there are two ſets of lymphatics:—the ſuperficial and deep ſeated. The firſt of theſe accompany the cutaneous veins, the latter the deep arteries.

As in general there are two great veins on the fore arm, the baſilic and cephalic veins; but particularly as the veins which gather into the baſilic trunk, on the inner and lower edge of the fore-arm, are the larger and more numerous claſs; ſo it is found that the courſe of the more numerous claſs of lymphatics is on the lower and inner ſide of the fore arm, and that they accumulate about the baſilic vein. Theſe are derived from the palm of the hand, and from the ulnar edge of the hand. This ſet ſometimes paſſes into glands, ſeated on the brachial artery, near the inner condyle of the humerus.

The abſorbents which accompany the cephalic vein, ariſe from the ſides of the thumb and fore finger upon the back of the hand; they run on the radial edge of the arm, with the veins which aſcend to form the cephalic vein. From the bend of the arm theſe veſſels take a courſe on the outer edge of the biceps, and then get betwixt the inner edge of the deltoid, and outer edge of the pectoral muſcles; they then paſs under the clavicle, and deſcend into the axillary glands. This ſet of abſorbents receive the branches from the outſide of the arm in their whole courſe.

There are abſorbents ariſing from the back of the hand, next the little finger, which following ſome of the branches of the baſilic vein (a larger branch of which is called the ulnaris externa) turn round the ulnar edge of the arm, are inſerted into a gland, very commonly found before and a little above the inner condyle of the humerus. From this gland a large lymphatic paſſes upwards, and attaching itſelf to the brachial artery, ſplits and plays around it.

The deep-ſeated lymphatics of the arm accompany the arteries in the ſame manner as the venæ comites do; in general two with each artery. They all terminate in the glands of the axilla, and can require no particular deſcription. The lymphatics, from the muſcles and integuments on the back of the ſhoulder, alſo turn round and enter into the glands of the axilla.

The GLANDS OF THE ARM are ſmall, and irregularly placed in the courſe of the humeral artery, from the condyle to the axilla. They are from three to ſix in number.

The GLANDS OF THE AXILLA are large and numerous; they receive the lymphatics from the arm, breaſt, and ſhoulder *; they lie in the deep cavity of the axilla, formed by the tendons of the pectoralis major, and latiſſimus dorſi muſcles. They are imbedded in a looſe cellular membrane, which, while it ſurrounds and ſupports the veſſels of the axilla in the motions of the joint, gives them ſtrength from its elaſticity. Theſe glands do not all ſurround the axillary artery; but a lower cluſter is attached to the branches of the ſubſcapular artery, going forward on the ſide of the cheſt, and to the thoracic arteries. Theſe it is which, indurating from cancer of the breaſt, require ſo frequently to be extirpated. Theſe glands of the axilla greatly inlarging cloſe upon the artery and plexus of nerves, ſo as to preclude the poſſibility of an operation; they compreſs the veins and benumb the arm by preſſure upon the nerves. When they ſuppurate, they cauſe a

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* "They even receive abſorbents from the cavity of the cheſt and I have known them ſwell from pleuriſy, peripneumony, and pulmonary conſumption." Cruickſhanks.

condenſation

condenſation of the cellular membrane which ſurrounds them, and in conſequence, a compreſſion of the axillary nerves and a ſhrinking of the arm.

When a wound or puncture, ſuch as that which the ſtudent of anatomy may receive in the diſſecting room, has been made on the little or ring finger, the red lines which often appear in conſequence of it, have taken the courſe of the ulnar edge of the fore arm, and terminated in the inſide of the arm, near the condyle; in ſome inſtances they have been continued even into the axilla. If venereal matter is abſorbed at any point of the hand, near the little or ring finger, or by thoſe fingers, the gland on the inner condyle of the humerus, or ſome one in the courſe of the brachial artery, will moſt probably inflame and form a bubo, and the ſurgeon will be aware of this abſorption; but if the venereal matter be abſorbed on the thumb or fore finger, it is poſſible that it may not paſs into the glands until it comes into the inſide of the clavicle. Theſe glands being out of our ſight and feeling, the patient may be infected without the ſurgeon ſuſpecting it *.

LYMPHATICS OF THE HEAD AND NECK.

Of the abſorbents of the brain, little is known preciſely; but none can deny the probability, next to an abſolute aſſurance and demonſtration, that the arteries, veins, and lymphatics bear the ſame relations in the brain as in the other parts of the ſyſtem. Lymphatic

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* Cruickſhanks, p. 182.

glands are obſerved in the courſe of the internal jugular vein, and even in the foramen caroticum, which are underſtood to belong to the lymphatics of the brain. The lymphatics of the head are to be obſerved in the courſe of the temporal and occipital arteries, which laſt terminate in glands, ſeated behind the maſtoid proceſs of the temporal bone. The lymphatics of the face have been obſerved very numerous accompanying the facial and temporal arteries. But thoſe from the internal parts of the face and noſe accompany the internal maxillary artery, and fall into the glands under the parotid, or in the courſe of that artery. Theſe glands are conſequently liable to diſeaſe, in conſequence of abſorption of matter from the face, throat, and noſe, and their extirpation is a very hazardous operation. The lymphatics from the gums and jaws alſo accompany the internal maxillary artery, and emerge under the angle of the jaw; and ſome of them joining the external jugular vein, paſs through glands near the top of the ſhoulder. The lymphatic veſſels from the tongue and parts about the os hyoides, take alſo the ſame courſe. The GLANDS about the FACE and JAWS are of the greateſt importance to the ſurgeon, for nothing is more common than the neceſſity of cutting out indurated lymphatic glands. Theſe are ſometimes miſtaken for diſeaſed ſalivary glands; now the ſalivary glands are rarely diſeaſed, the lymphatic glands often. And it will be a guide to the ſurgeon to inquire into the original cauſe of the induration, (perhaps a ſuppuration in the throat, noſe, or jaws) and to know preciſely the gland diſeaſed, its depth, and connections.

On the ſide of the face, there are in general ſeveral ſmall lymphatic glands on the buccinator muſcle immerſed in the ſurface of the parotid gland, under the zigomatic proceſs. There are alſo glands to be carefully noted, which lie under the tip of the parotid gland, where it extends behind the angle of the jaw, and alſo lying under the baſe of the jaw-bone, cloſe to the ſub-maxillary gland, and on the courſe of the facial artery.

The GLANDS and ABSORBENTS of the neck are very numerous, and the latter form an intricate and beautiful plexus, ſeveral branches of which are to be obſerved accompanying the external and internal jugular veins. Some of the glands lie immediately under the ſkin, and in the cellular membrane, on the outer edge of the platiſma myoides; many under that muſcle, and in the courſe of the external jugular vein. But there are many ſeated deep, for the greater number accompany the internal carotid artery, and internal jugular vein or their branches.

The lymphatics of the THYROID GLAND have been raiſed by Mr. Cruickſhanks, by plunging a lancet at random into the ſubſtance of the gland, and blowing into it, or throwing quickſilver into its cellular membrane. The trunks of theſe lymphatics join the thoracic duct on the left ſide; and on the right ſide the right trunk, juſt as it is about to enter into the veins.

OF THE TRUNKS OF THE ABSORBENT SYSTEM.

THE larger and proper trunk of the lymphatic ſyſtem, is generally called the THORACIC DUCT, becauſe it was firſt obſerved by Pecquet * to be a veſſel which conveyed the chyle through the diaphragm, and which took its courſe through the whole length of the thorax, to throw its fluids into the veins near the heart. Before his time the lacteals which were diſcovered by Aſellius †, were ſuppoſed to terminate in the liver. The firſt diſcoverers of the thoracic duct, deſcribed it as beginning from a pyriform bag, to which they gave the name of RECEPTACULUM CHYLI. In dogs, fiſh, and the turtle, ſuch a ciſtern or bag may be obſerved; but in the human body nothing further is to be obſerved than an irregular dilatation of this veſſel, like a varicoſe diſtention, where it receives the acceſſion of the lacteals from the root of the meſentery. The origin of this great trunk, called the thoracic trunk, is the union of the veſſels, which running by the ſide of the common iliac veſſels, are derived from the pelvis and lower extremities. Upon the third and fourth vertebræ, and under the aorta this trunk is frequently joined by a large trunk of the lacteals, and then aſcending, it receives the greater number, or the larger trunks of the lacteals. On the vertebræ of the loins, the thoracic duct is by no means regular, either in its courſe or ſize or ſhape; often it contracts, and again irregularly dilates, as it ſeems to emerge from under the aorta. On the uppermoſt vertebra of the loins, the thoracic duct lies under the right crus of the diaphragm, and then paſſing the ſeptum with the aorta, it gets on the right anterior ſurface

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* In the year 1651.

† In the year 1622.—About the year 1652, the other branches of the ſyſtem, which take their courſe to every part of the body, were diſcovered by Rudbeck, Jolyffe, and Thom. Bartholin.

of the ſpine, and runs up betwixt the aorta and the vena azygos; it then paſſes under the arch of the aorta, and there it is conſiderably enlarged, from the contracted ſtate which it aſſumes in the thorax. Sometimes it ſplits, and again unites on the vertebræ of the back. Having paſſed the arch of the aorta, it croſſes to the left ſide of the ſpine, and we look for it under the pleura on the left ſide of the œſophagus.

The thoracic duct now emerges from the thorax, and lies deep in the lower part of the neck, behind the lower thyroid artery, and on the longus colli muſcle.

It gets above the level of the ſubclavean vein of the left ſide, and here it receives the abſorbents of the head and neck (of the left ſide), and deſcends again with a curve, and terminates in the angle of the union of the ſubclavean vein and jugular vein of the left ſide.

Sometimes there are two thoracic ducts; but this is very rare. Sometimes the duct ſplits near its termination, and the two branches enter the veins ſeparately; but, in general, when it ſplits in this manner, it again unites before it terminates in the vein.

There is conſtantly a trunk in the anterior mediaſtinum under the ſternum, as large as the thoracic duct itſelf, which is ſometimes inſerted into the termination of the thoracic duct; ſometimes into the trunk of the abſorbents of the left ſide, to be immediately deſcribed *.

THE TRUNK OF THE ABSORBENTS OF THE RIGHT SIDE.

THE abſorbents, from the right ſide of the head and neck, and from the right arm, do not run acroſs the

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* Cruickſhanks.

neck, to unite with the great trunk of the ſyſtem; they have an equal opportunity of dropping their contents into the angle betwixt the right ſubclavean and the jugular vein. Theſe veſſels then uniting, form a trunk which is little more than an inch, nay, ſometimes not a quarter of an inch in length, but which has nearly as great a diameter as the proper trunk of the left ſide.

This veſſel lies upon the right ſubclavean vein, and receives a very conſiderable number of lymphatic veſſels: not only does it receive the lymphatics, from the right ſide of the head, thyroid gland, neck, &c. and the lymphatics of the arm; but it receives alſo thoſe from the right ſide of the thorax and diaphragm, from the lungs of this ſide, and from the parts ſupplied by the mammary artery. Both in this and in the great trunk there are many valves.

OF THE LACTEALS AND LYMPHATICS OF THE INTESTINAL CANAL.

We have already remarked the great length of the inteſtinal canal, the effect of the imperfect valvular ſtructure, in extending the inner coat to a great length; we have remarked alſo, that while every ſurface of the body ſecretes, it is at the ſame time an abſorbing ſurface; and finally, that while we chiefly contemplate the inteſtinal canal, as imbibing and receiving the nouriſhment, we muſt not forget that it is alſo a ſecreting ſurface of the firſt importance to the œconomy. But at preſent we have merely to underſtand that ſtructure and organization, by which this canal abſorbs the nutritious fluid the chyle from the food.

In the firſt place, as to the terms lacteals and lymphatics, we preſume that the abſorbents throughout the whole length of the canal have the ſame ſtructure and uſe; and that the term lacteals has been ſuggeſted merely by the colour of the fluid, which is abſorbed from the ſmall inteſtines. At one time theſe lacteals convey a milky fluid: at another a tranſparent fluid, like that which the ſtomach and great inteſtines in general abſorb.

The lacteals, as it is natural to ſuppoſe, were the firſt diſcovered of any part of the ſyſtem of abſorbents; or, at leaſt, they were firſt underſtood to form a part of an abſorbing ſyſtem. For although Euſtachius, a Roman anatomiſt, diſcovered the thoracic duct in the year 1563, yet he had very imperfect notions of its importance, and the diſcovery was very little attended to, till after the diſcovery of the lacteals by Aſellius in 1622. This anatomiſt, in opening living animals, to obſerve the motion of the diaphragm, obſerved white filaments on the meſentery, which he took at firſt for nerves; but, on puncturing them, and obſerving them to diſcharge their contents and to collapſe, he proclaimed his diſcovery of a new ſet of veſſels—a fourth kind *.

Had Aſellius only chanced to obſerve theſe veſſels, his merit would have been inconſiderable; but he alſo inveſtigated and announced their peculiar office, viz. of abſorbing the chyle from the inteſtinal canal, and carrying it into the blood.

For ſome time, however, after the diſcovery of the vaſa lactea, the opinion of Hypocrates and Galen,

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* The nerves being counted as veſſels.

viz. that the meſenteric veins abſorbed the chyle from the inteſtines, and conveyed it to the liver, ſtill prevailed. Even after the diſcovery of the lacteals was known and received, a part of the old ſyſtem was ſtill retained, and it was ſuppoſed that thoſe veſſels carried the fluids abſorbed from the inteſtines into the liver; and that the fluids were there converted into blood.

About twenty years after the diſcovery of Aſellius, Rudbeck, a Swede, and Bartholin, a Daniſh anatomiſt, ſaw Aſellius's veſſels in many other parts of the body; diſcovered the trunk of the ſyſtem, and ſhowed that the lacteals did not paſs to the liver, but that they were branches of a great and diſtinct ſyſtem; they alſo demonſtrated the unity of this ſyſtem.

We have ſeen from this ſketch that the ancients ſuppoſed the veins of the inteſtines to be abſorbents; and even after the diſcovery of the lacteals, this idea has been retained by ſome of the beſt modern anatomiſts, and principally by Haller, and profeſſor Mickel of Berlin. If the veins abſorb from the ſurface of the inteſtines, their doctrine would imply that they are alſo abſorbents in general throughout the body. Although Bartholin, in his epiſtle to Harvey, had aſſerted and given ſufficient proof that the meſenteric veins were not abſorbents, yet the controverſy was left in ſo undecided a ſtate, as to give occaſion to the ſeries of experiments in the ſchool of the Hunters, which ſeems to have put the queſtion to reſt, in as far as it is connected with the lymphatic ſyſtem *.

We have already mentioned that Aſellius was employed in opening the belly of a living dog, when he

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* See the VEINS in this volume.

firſt diſcovered the lacteals. He perceived upon the ſurface of the inteſtines and meſentery a great many ſmall threads, which, at firſt ſight, he took for nerves, but ſoon diſcovered his error; and to diſſipate his doubt, opened one of the largeſt white cords, when no ſooner had the inciſion been made, than he ſaw a fluid like milk or cream iſſue from the veſſels. Aſellius ſays he could not contain his joy at the ſight of this phenomenon; and turning himſelf to Alexander Tadinus, and the ſenator Septalius, who were preſent, he invited them to enjoy the ſpectacle;—but his pleaſure, he adds, was of ſhort duration, for the dog died, and the veſſels diſappeared. The natural and ſimple narration of Aſellius repreſents his aſtoniſhment, and gives an idea of the ſenſation, which the anatomiſt experiences in the inſtant of making an intereſting diſcovery *.

ORIGIN OF THE LACTEALS. When the young anatomical ſtudent ties the meſenteric veſſels of an animal recently killed, and finds the lacteals gradually ſwell; when he finds them turgid, if the animal has had a full meal, and if he has allowed time for the chyle to deſcend into the ſmall inteſtines—and empty, or containing only a limpid fluid if the animal has wanted food; he has ſufficient proof that theſe are the veſſels deſtined to abſorb the nutritious fluids from the inteſtines. Again, when coloured fluids are thrown into the inteſtines of a living animal, and they are abſorbed, he has ſufficient proof of their free and ready communication with the inner ſurface of the gut; but the actual demonſtration of the abſorbing mouths of the

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* Sheldon, Portal.

lacteal veſſels is difficult and precarious. The difficulty ariſes from theſe veſſels being in general empty in the dead body; from the impoſſibility of injecting them from trunk to branch in conſequence of their valves; and, laſtly, from their orifices never being patent, except in a ſtate of excitement. The anatomiſt muſt therefore watch his opportunity when a man has been ſuddenly cut off in health, and after a full meal. Then the villi of the inner coat may be ſeen turgid with chyle, and their ſtructure may be examined. Perhaps the firſt obſervations which were made upon this ſubject by Lieberkuhn, are ſtill the beſt and the moſt accurate.

The villi are apparently of a cellular ſtructure, for although they are flat or conical, or like filaments when collapſed; yet when minutely injected, and eſpecially when they are full of chyle, they take a globular form, and are called the AMPULULÆ. Their diſtention, in conſequence of a minute injection of the veins or arteries, is probably owing to a cellular ſtructure (which they ſeem to have) into which the injection has extravaſated. The moſt probable account of the ſtructure of theſe ampululæ is that this cellular ſtructure is a proviſion for their inflation and erection by the blood, when excited by the preſence of the chyle in the inteſtines; that this erection gives rigidity to the orifice of the lacteals; and that the firſt ſtep of abſorption is by capillary attraction, while the further propulſion of the fluid in the extreme abſorbents is by the contraction of their coats excited by the preſence of the fluid. Thus the abſorption is not by an inorganized pore, but depending on excitement and action.

Lieberkuhn's obſervations of the villi are the moſt accurate and curious. He obſerves, that having opened and waſhed a portion of the ſmall inteſtine, its whole ſurface will be found covered with little pendulant conical membranes of the fifth part of a line in ſize, and the baſes of which almoſt touch each other. From the vaſcular membrane, to which they are attached, he obſerves there is given off to each villus a branch of a lacteal, an artery, a vein, and a nerve. He found it difficult by injection to ſhow both the vein and artery, the fluid paſſed ſo eaſily from the one into the other. He found that the extreme branch of the lacteal was diſtended into a little veſſel within the villus. And on the apex of which, with the microſcope, he ſaw one or ſometimes ſeveral openings; with his glaſſes he obſerved the arteries to ramify on the globules or ampululæ and again collect into veins; and he ſuppoſed that ſtill more minute branches plunged into the centre. But he made a ſtill more minute obſervation than this. Inſulating a piece of inteſtine betwixt two rings, only leaving a ſpace for the entrance of the ramification of the artery which ſupplied it, he injected with a column, and examined its progreſs at the ſame time with his microſcope. As he raiſed the tube, he ſaw the artery going in ſerpentine turns to the villus, and the injection returning by the veins; at laſt it paſſed into the ampula lactea, diſtended it and made its exit by the foramina. He prepared the villi in another way:—he inflated the ampulæ, and kept them ſo until they dried; then he cut them with a razor, and found them cellular. This cellular ſtructure Cruickſhanks thinks is the common cellular ſubſtance, uniting the veſſels of the villus. When this gentleman examined the villi of a patient who died ſuddenly after a meal, he obſerved ſome of them to be turgied with chyle, ſo that nothing of the ramifications of the arteries or veins were to be obſerved; the whole appeared as one white veſſel without any red lines, pores, or orifices; others of the villi contained chyle in a leſs proportion; and here the ramifications of the veins were numerous, and prevailed by their redneſs over the whiteneſs of the villi.

In ſome hundred villi he ſaw the trunk of a lacteal forming by radiated branches, one branch in each villus. Mr. Cruickſhank and Dr. Hunter counted fifteen or twenty orifices in ſome of the villi.

Mr. Cruickſhank has remarked a deep and a ſuperficial ſet of lacteals on the inteſtines; but for this diviſion there ſeems no neceſſity. Deep in the coats the lacteals ſeem to accompany the blood veſſels; but when they get more ſuperficial, they take a courſe longitudinally on the canal, and turn deviouſly, or after running a little way, take a ſudden turn towards the meſentery.

As the greater frequency of the valvulæ conniventes in the jejunum, greatly encreaſe the extent of its inner ſurface of the gut, and conſequently give a greater extent of origin to the lacteals; and, as here the chyle muſt be in the greater quantity, ſo the lacteals of this portion of the gut are larger and more numerous than in any other part of the extent of the canal.

The lacteals do not attach themſelves to the veſſels of the meſentery, but take a courſe individually, or forming plexus. Before they enter the meſenteric glands, they have been called lacteals of the firſt order;

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when they emerge from the firſt into the ſecond glands, ſecondary lacteals, and glands of the ſecond order. The manner of the entering and going out of glands is exactly the ſame with that of the lymphatics. The lacteals (or perhaps we ſhould now ſay the abſorbents merely) of the great inteſtines, are ſmaller and leſs numerous than thoſe of the ſmall inteſtines; for although the inteſtines be large, ſtill their inner ſurface is by no means ſo extenſive: beſides the chyle is abſorbed, and the contents altered before they have deſcended into the great inteſtines. Both Winſlow and Haller, however, aſſert, that they have ſeen chyle in the abſorbents of the great inteſtines. We know that the lacteals abſorb chyle, when it is preſented to them: while at other times they abſorb different fluids. That the abſorbents of the great inteſtines imbibe the fluids contents is evident, from the change produced on the fæces in their paſſage. Copious and nutritious injections have been given, which did not return in the ſame liquid form, and which have ſupported the ſtrength for ſome time. Clyſters of turpentine give the urine a ſmell of violets; and the Peruvean bark has cured fever, when given by the rectum.

The abſorbents of the ſtomach form three diviſions: one ſet accompany the coronary artery and vein, and enter the glands on the leſſer curvature and omentum minus. Thoſe of the ſecond ſet accompany the left gaſtro-epiploic artery, and are joined by the lymphatics of the omentum. The third paſs down upon the upper part of the duodenum following the arteria gaſtrica dextra: theſe deſcend to paſs into the ſame claſs of glands, which receive the lymphatics of the liver. They are joined in their courſe by the lymphatics of the right ſide of the omentum.

The lacteals on the meſentery paſs from one gland to another till they form one or two large trunks only. Theſe accompany the trunk of the ſuperior meſenteric artery, and run down on the right ſide of the aorta, and join the thoracic duct. The abſorbents, from the rectum and colon of the left ſide, paſs into their glands, or ſometimes into the lumbar glands, and join the thoracic duct ſeparately; thoſe from the right ſide of the colon join or mingle with the lacteals in the root of the meſentery.

OF THE REMAINING ABSORBENTS OF THE SOLID VISCERA.

Where the lymphatics of the lower extremity deſcend over the brim of the pelvis, they are joined by the abſorbents of the bladder, veſiculæ ſeminales, and other parts in the pelvis:—ſmall glands belonging to this ſet are attached to the internal iliac veſſels. In the female, the lower ſet of lymphatics, from the womb and vagina, alſo come by this route to join thoſe of the lower extremity, or run mingling with them. Another ſet of lymphatics of the womb paſs up with the ſper- veſſels.

The lymphatics of the TESTICLE are very numerous. They come in diſtinct ſets from the body of the teſticle, from the epididimis, and from the tunica vaginalis: then reaching the cord, form ſix or ten trunks, and run up direct to the abdominal ring; paſſing the ring, they turn outward, and then paſs over the pſoas muſcle and into the lumbar glands.

The lymphatics of the KIDNEY are in two ſets, ſuperficial and deep ſeated; but the former are ſeldom to be obſerved. Sometimes diſeaſe makes them diſtinct. The internal lymphatics are demonſtrated by blowing into the veins, or tying a ligature and kneading the ſubſtance of the kidney with the fingers; when they riſe, they are ſeen attached to the emulgent veſſels, and go to join the lumbar glands, or terminate in large lymphatics near the aorta.

It is needleſs to repeat that the abſorbents of the ſpleen are deep and ſuperficial,—for this arrangement is general. Emerging from the ſpleen, the lymphatics paſs alongſt the ſplenic veſſels, and enter into glands attached to the ſplenic artery in its whole courſe. In this courſe they receive the abſorbents from the pancreas, and near the head of the pancreas, they are blended with thoſe of the liver, and with them join the thoracic duct.

The lymphatics of the liver are the moſt eaſily detected, and may be injected to greater minuteneſs, than in any other part of the body. Although they have many valves, yet they do not ſeem to cloſe the veſſels intirely, nor interrupt the mercury from paſſing from trunk to branch. The ſuperficial lymphatics, which are ſo numerous that we may ſometimes ſee the mercury in them covering completely a conſiderable ſpace, have free communication with the internal ſet of veſſels which are alſo numerous and large. The principal route of the lymphatics of the upper ſurface of the liver, is by the broad ligament: theſe perforating the diaphragm join the trunk, which we have noticed under the ſternum, and in the anterior medeaſtinum. It would appear, however, that theſe lymphatics of the broad or ſuſpenſory ligament, are by no means conſtant and uniform in their courſe; for ſome times the run down towards the lacteal ligament, and perforate it there; ſome times they paſs down into the thoracic duct while ſtill in the belly. Other lymphatics of great ſize, run off from the convex ſurface of the liver upon the lateral ligaments, and pierce the diaphragm. The lymphatics on the lower or concave ſurface of the liver are more irregular than thoſe of the convex ſide. They unite with the deep lymphatics coming out of the porta alongſt with the vena portæ, enter into the glands, which are ſeated on the trunk of that veſſel, and join the thoracic duct near the root of the ſuperior meſenteric artery.

The lymphatics of the LUNGS are nearly as numerous as thoſe of the liver; but, indeed, in regard to this expreſſion, it is more in relation to the facility of injecting and demonſtrating the lymphatics, than to their comparative number. For example, if the lymphatics of the other viſcera could be injected to as great minuteneſs as thoſe of the liver, we ſhould ceaſe to conſider that viſcus as more abundantly ſupplied than other parts. The ſuperficial lymphatics of the lungs form areolæ, and cover the ſurface almoſt completely. They take a courſe to the root of the lungs, where they are joined by the deep ſeated veſſels, and together paſs into the bronchial glands, and here the lymphatics of both ſides freely communicate.

The glands of the lungs are conſtantly found both before and behind the bifurcation of the trachea: often theſe gland are of a very dark colour; nay, their ſubſtance is ſometimes found reſolved as it were into a ſac of inky-like fluid. Upon the arch of the aorta, and the root of its great branches, are the CARDIAC GLANDS, which receive the lymphatics from the heart. The abſorbents of the heart are ſmall, but very numerous, and their larger branches attach themſelves to the coronary veſſels. They then paſs to the cardiac glands, and mingling with thoſe from the lungs, join the thoracic duct.

APPENDIX;

CONTAINING THE

DESCRIPTION OF THE VENOUS SYSTEM AND THE ANATOMY OF THE TEETH.

CHAP. I.

OF THE VEINS IN GENERAL.

THE veins are thoſe veſſels by which the blood carried outward by the arteries, is returned to the heart. The ſyſtem of the veins however is not ſo ſimple as that of the arteries, for while there are only two great arteries carrying the blood from the heart, viz. the aorta and the pulmonic artery, there are three great trunks of the veins, viz. the ſuperior and inferior vena cava, the trunks of the great veins of the body; the pulmonic vein, which returns the blood to the heart from the circulation through the lungs; and the vena portæ, which collects the blood of the inteſtines, and conveys it to the liver. There are beſides, a greater variety in the diſtribution of the veins, than in that of the arteries.

The French phyſiologiſts have departed from the old method of Harvey, in explaining the circulation. He wiſely took the heart as the centre of the ſyſtem, and deſcribed the veſſels going out from it, forming the two circulations, viz. throughthe body and through the lungs; but they have aſſumed the lungs as the centre; and the veins of the body, and the arteries of the lungs, they call *ſyſteme à ſang noir*, becauſe it contains the dark coloured blood; and the pulmonic veins and the arterial ſyſtem of the body, they call *ſyſteme a ſang rouge*, becauſe it conveys blood of the bright vermilion colour.

This conceit is perhaps admiſſible, when introduced as an illuſtration of the relation of the lungs to the body; but in the general announcing of the ſyſtem, and conſidered as a baſis of demonſtration, it gives to a difficult ſubject an unuſual degree of intricacy in the mind of the young ſtudent: beſides, the arteries and veins of the body, and the pulmonic artery and vein, have that ſtrict and mutual dependence in action, which ſhows how improper and how unnatural it is to make this change, and to ſeparate them in explaining the general ſyſtem. At all events, let thoſe who adopt this novelty ceaſe to ſpeak of the two circulations, for although in regard to the heart, there are two circulations, yet as the movement of the blood reſpects the lungs, there is only one. By this diviſion, the blood returning from the body and carried into the lungs, cannot be called a circulation; but only when it has paſſed through the lungs, and returned to the ſame point of its courſe through the body.

GENERAL CHARACTER OF THE VEINS.—The capacity of the veins, is larger than that of the arteries; the coats thinner but ſtronger comparatively, and admitting of much dilatation. The coats of the leſſer veins, are comparatively ſtronger than thoſe of the larger ones, and the veins of the lower extremity much thicker and ſtronger,

ſtronger than in the upper parts of the body, as they bear a higher column of blood. The veins are tranſparent and the blood is ſeen through their coats. There can be properly diſtinguiſhed, only two coats in the veins: the outer coat, which is floculent and cellular without, to connect with the ſurrounding parts, ſmoother and more compact within, where it is united with the inner coat. In it are ramified the vaſa vaſorum; and a fibrous ſtructure is to be obſerved in ſome of the larger and ſuperficial trunks; the ſtriæ or fibres running longitudinally. The inner coat is firm and compact and intimately united to the other; it is ſmooth, flexible, and formed into valves in various parts.

In all the larger veins, excepting thoſe of the viſcera of the abdomen, and thoſe of the lungs and brain, there are valves: theſe valves conſiſt of the inner coat, forming folds like a ſemilunar curtain, hung acroſs the caliber of the vein; but at the ſame time attached ſo obliquely to the ſide of the vein, that they preſent a ſacculated membrane to receive the refluent blood. The looſe margin of the valve is ſomewhat ſtronger than the other part, and betwixt the duplicature ſome ſplendid little filaments are ſometimes obſerved. Each valve conſiſts in general, of two ſemilunar membranes, the margins of which, falling together, prevent the blood from paſſing retrograde; but they yield and collapſe to the ſide of the vein by the current of blood flowing towards the heart. As the veins are provided with valves only where they are expoſed to occaſional preſſure, and particularly to the compreſſion of the muſcles; their chief uſe would ſeem to be, to prevent the retrograde movement of the blood, from the occaſional compreſſion of the veins; but no doubt, they at the ſame time ſupport the column of blood, as in the lower extremities: and when thoſe veins ſuffer diſtention by diſeaſe, a great aggravation is, that the valves loſe their action, become too ſmall to cloſe the dilated vein, and the whole column of blood preſſes upon the veins of the legs.

The commencement of the minute branches of the veins, is from the extreme ramifications of the arteries; they are continuous, and perpetuate the motion of the blood in that courſe which is called the circulation. In contemplating the capillary tiſſue of veſſels, the moſt ſtriking circumſtance is, the predominance of the dark venous ramifications: and in general, two ſets of veins will even in theſe minute ramifications, be obſerved; one ſuperficial, the other more intimately blended with theſe minute ramifications of the arteries; but in the internal parts of the body, and particularly the viſcera, the veins uniformly accompany the ramifications of the arteries, and in the ſolid viſcera, a denſe cellular membrane gives promiſcuous lodgement to both ſets of veſſels.

In the extremities and head, indeed every where but in the viſcera, the veins form two diſtinct ſets; the deep and the ſuperficial veins: the deep veins accompanying the arteries; and the ſubcutaneous veins, which emerge from the compreſſion of the muſcles, and run above the faſcia. The union betwixt the branches of the veins, is very frequent, not only betwixt the veins, ramifying in the ſame plane in ſo much as to make them a mere network; but alſo betwixt the deep and the ſuperficial ſet of veins: ſuch are the venæ emiſſariæ of the ſcull; the free communications betwixt the external and internal jugular vein, betwixt the deep and ſuperficial veins of the arm, &c. When in bleeding, the blood flows from the vein of the arm, accelerated by the working of the muſcles, the blood eſcapes by the anaſtomoſis, from the compreſſion of the muſcles, and fills the ſuperficial veins; but the increaſe of the jet of blood, is more the effect of the ſwelling of the muſcles, cauſing the faſcia to compreſs the veins of the fore arm.

In the dead body the veins are flat, but when diſtended, they reſume the cylindrical figure which they poſſeſſed in the living body: yet they are in general of the cylindrical figure, for a very little way only, owing to the irregular dilatations by the ſide of the valves, or by the frequent union of their branches. The manner in which the branches join the trunk, has a peculiarity which always diſtinguiſhes it from the ramifications of arteries: the arteries branch off at a direct and acute angle, the veins in a direction more removed from the courſe of the trunk, and in general with a curve or ſhoulder.

In infancy and youth, the veins are little turgid, and eſpecially the cutaneous veins, are ſo firmly embraced by the elaſtic ſkin and cellular membrane, that they have a leſs degree of prominency than in more advanced years. In old age, the veins are enlarged, and riſe turgid on the ſurface, and the internal veins alſo become enlarged and varicoſe. I do not conſider this change in the vaſcular ſyſtem, as the effect of mere diſtention, or of the enlargement of the veins from the long-continued action of the arteries; but as a neceſſary

ceſſary change in the proportionate diſtribution of the blood, which is preceded or accompanied with other peculiarities, the character of old age. When we conſider the great proportion of the veins in ſize, over the arteries, we muſt conclude that the blood flows but ſlowly in the venous ſyſtem: that from the narrowneſs of the trunks of the veins near the heart, the blood muſt be accelerated, as it approaches the heart, and that receiving the impulſe from the ventricle, it muſt take a rapid courſe through the arteries, until again approaching the extreme branches of the arteries and paſſing into the veins, its motion becomes more languid and ſlow. In youth, as the ſize of the veins is not in ſo great a proportion to the arteries, as in advanced life; the blood in a young perſon, muſt be in more rapid and quick circulation: but in old age, in proportion to the largeneſs of the veins and the accumulation of blood in them, the quantity of blood moving ſlowly through the venous ſyſtem, and almoſt ſtagnant in the dilated veins and ſinuſes, is very great; it moves but ſlowly and progreſſively on towards the centre of the circulation; and upon the whole, the blood in old people, moves leſs briſkly through the veſſels, and the proportionate quantity immediately under the influence of the arterial ſyſtem, is leſs than in youth.

There is no pulſation to be obſerved in the veins, but what they receive laterally from the contiguous arteries. There is no pulſation in the veins, becauſe they are removed from the heart; becauſe they do not receive the ſhock of the heart's action in their trunk, but only by their widely ſpread branches; becauſe the contraction of the heart, and of the arteries ſo alternate with each other, in ſuch a manner as to keep up a perpetual and uniform ſtream of blood into the veins; whereas the pulſation in the arteries is owing to the ſudden and interrupted contraction of the heart.

In this general account of the venous ſyſtem, it remains only to ſpeak of the ſubject of abſorption. Before the ſuite of experiments made on this ſubject by Mr. Hunter, a vague notion was entertained that the veins were abſorbents; but about that time*, the doctrine that lymphatics are abſorbents having been eſtabliſhed, the opinion that the red veins were alſo abſorbents, was firſt queſtioned, and finally confuted, at leaſt in the opinion of moſt phyſiologiſts.

The chief argument to ſhow that veins, ariſing from cavities, particularly from the inteſtines, acted as abſorbents, was, that ſome anatomiſts ſaid they had ſeen white chyle in the blood taken from the meſenteric veins. It was however ſoon obſerved that the ſerum of the blood, taken from the veins of the arm, was ſometimes white, which muſt ariſe from ſome other cauſe than the abſorption of chyle †.

The experiments of Mr. John Hunter, proved that there is no abſorption of fluid, from aliment contained in the inteſtinal canal, by the veins of the meſentery, while the lacteals were rapidly abſorbing. Emptying a portion of the gut, and the veins of their blood in a living animal, he poured milk into the inteſtine. The veins remained empty, and without a drop of the milk finding its way into them, while the lacteals became tinged with it. In another experiment, leaving the arteries and veins of the meſentery free, and the circulation through them perfect; ſtill no white fluid could be diſcovered, tinging the ſtream of blood in the veins. Neither did preſſure upon the gut, in any inſtance force the fluid of the inteſtines into the veins.—He repeated and varied theſe experiments, ſo as to ſhow in a very ſatisfactory manner, that chyle, or the fluid of the inteſtines, never is abſorbed by the veins.

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* 1758.

† See Hewſon Exper. Eſſays and Lymphatic Syſtem.

Yet I muſt ſay that theſe experiments are ſtill unſatisfactory, as they regard the general doctrine of abſorption by the veins: in the inteſtines there is a peculiar ſet of veſſels evidently deſtined to the abſorption of the chyle and of the fluids of the cavity; but there remains a queſtion which will not be eaſily determined: do not the veins throughout the body reſume a part of that ſubſtance, or of thoſe qualities, which are depoſited or beſtowed by the arteries?—We are aſſured that in the circulation of the blood through the lungs, and in the extremities of the pulmonic veins, there is an imbibing or abſorption: and in the veins of the placenta, there is not only an abſorption ſimilar to what takes place in the extreme branches of the pulmonic circulation, but the matter and ſubſtance which goes to the nouriſhment of the fœtus, is imbibed from the maternal circulation *. So by the veſſels in the membrane of the chick in ovo, there is abſorbed that

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* Dr. Hunter, Hewſon, &c. ſay that it is probable there are many ſmall lymphatics in the placenta, which open into the branches of the veins, and do not take a courſe along the cord. This is very improbable, and has no ſupport from analogy.

which being carried to the chick, beſtows nouriſhment and encreaſe. For my own part, I cannot but ſuppoſe that, while the lymphatics abſorb the looſe fluids which have been thrown out on ſurfaces, or into cavities—the veins receive part of what is depoſited from the arteries; but, which is not ſo perfectly ſeparated from the influence of the circulating ſyſtem, as that which the lymphatics receive; and that there are certain leſs palpable, and perhaps gaſeous fluids, which they imbibe in the courſe of the circulation by an affinity of the venous blood, ſimilar to the attraction which takes place in the lungs. We muſt at the ſame time acknowledge, that the concluſions made in favour of abſorption by veins, from experiments upon the dead body, are falacious, and have no weight.—It is ſeldom we can determine whether minute injections have taken a courſe by a natural, or by a forced paſſage: neither are the experiments of ſome of the older phyſiologiſts more ſatiſfactory or concluſive. Lower affirmed that, by throwing a ligature on the inferior cava of a dog, he produced aſcites. He tied the jugular veins of a dog, and the head became dropſical. Hewſon repeated theſe experiments, but without the ſame reſult. And if the tying of the veins had always produced œdema or dropſy, the experiment would have proved nothing more than is already eſtabliſhed by the very common occurrence of œdema of the legs, from the preſſure of the womb on the iliac veins, or a tumor in the groin, or in the pelvis. Now in theſe inſtances the compreſſion of the vein does nothing more than cauſe a difficult circulation of the blood, from the extreme arteries into the veins, and conſequently a greater profuſion of the diſcharge into the cellular texture by the ſerous arteries.

OF THE VEINS, BRANCHES OF THE SUPERIOR VENA CAVA.

The ſuperior vena cava, or the deſcending cava, is the ſuperior trunk of the venous ſyſtem; which receives the veins of the head, neck, and arms, and throws the blood directly into the great right ſinus, or auricle of the heart.

SECTION I.

OF THE VEINS OF THE HEAD AND NECK.

THE ANTERIOR FACIAL VEIN *. The facial, or anterior facial vein, runs down obliquely from the inner canthus of the eye, towards the angle of the lower jaw-bone. Here uniting with the temporal vein, it forms the external jugular vein. The moſt remarkable branches of veins which aſſiſt in forming the facial vein, are the FRONTAL VEINS; which receive the blood from the forehead and frontal portion of the occipito-frontalis muſcle, and the OPHTHALMIC VEIN, which is one of the emiſſariæ, and comes from the cavernous ſinus through the orbit.—In its courſe down the cheek, the facial vein receives the ſeveral cutaneous branches of

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* *Facial vein; V. Angularis; V. Triangularis.*

veins from the ſurrounding parts : but which have in reality no ſuch importance as to require deſcription *.

THE POSTERIOR FACIAL VEIN; OR, GREAT TEMPORAL VEIN.—This vein deſcends from the temple before the ear, through, or under the maſs of the parotid gland, and behind the angle of the lower jaw.

This poſterior vein receives thoſe branches which are the proper temporal veins, and which are four in number, and deſcend upon the ſide of the head †; and thoſe which anſwer to the ſubmaxillary artery, and alſo the vena tranſverſa faciei, and the auricular veins. Finally into ſome of the deep branches of this vein ‡ the blood enters from the veins accompanying the arteria meningea. The poſterior facial vain, uniting with the anterior one, forms a common trunk, which in general lies over the diviſion of the carotid artery.

EXTERNAL JUGULAR VEINS.

THE external jugular vein takes a courſe obliquely down the neck, and acroſs the middle of the maſtoid muſcle. It lies under the fibres of the platyſma myoides muſcle, and drops either into the ſubclavean vain, or into the internal jugular vein. Sometimes there are two external jugular veins on each ſide; more commonly

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* *Vena dorſalis naſi, ſuperior et inferior—Vena palpebralis inferior externa et interna—Vena alaris naſi—Venæ labiales magnæ et minores*, &c. *Venæ buccales*, &c.

† Being in two ſets, the deep, and ſuperficial.

‡ *Viz. Venæ Pterygoideæ.*

monly there are two branches high in the neck, from the anterior and poſterior facial veins, which unite about the middle of it. When they are double they have this courſe; the *anterior and external* jugular vein, may be ſaid to begin from the anterior facial vein; it then receives the ſubmental vein, which comes in under the baſe of the lower jaw—the ranine veins alſo, and veins from the glands under the jaw join it here: where it is before the maſtoid muſcle, it forms free communications with the internal jugular veins; and here alſo, it receives veins from the ſide of the throat [*].

Almoſt all the ramifications of veins, which in one ſubject unite to the external jugular vein, and which come from the face and throat, do in others ſink down into the internal jugular vein.

Sometimes the anterior and external jugular veins join the internal jugular vein; ſometimes the ſubclavean vein.

The poſterior external jugular vein is formed chiefly by the temporal vein, or, poſterior facial vein, which comes down from under the parotid gland; it is then joined by the occipital veins [†], a little lower by the cervical veins, and laſtly on the lower part of the neck it receives the muſcular branches from the fleſh of the ſhoulder; it then ſinks into the ſubclavean veins.

OF THE THYROID VEINS.—The thyroid gland has two ſets of veins, as it has of arteries; the *ſuperior thy-*

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[*] Viz. The ſuperior thyroid veins, and the deep laryngeal veins.

[†] Theſe communicate with the vertebral veins, and through the poſterior maſtoid foramen with the lateral ſinus.

roid veins carry back the blood from the muſcles of the fore-part of the throat, from the larynx, from the ſubſtance of the thyroid gland, and from the neighbouring part of the trachea and pharynx, and even from the fauces. Sometimes theſe thyroid veins enter the external jugular vein; ſometimes they deſcend upon the neck, taking the name of GUTTURAL VEINS; they unite themſelves with the internal jugular vein.

THE LOWER THYROID VEINS.—Come from the lower part of the thyroid gland, and deſcend upon the fore-part of the trachea, and enter the ſubclavean; or, more generally, the great, or internal jugular veins.

OF THE INTERNAL JUGULAR VEIN.—The internal jugular vein is formed by the conflux of the ſeveral great and poſterior ſinuſes of the dura mater into the lateral ſinus, which coming out by the foramen lacerum poſterius of the baſis cranii, ceaſes to be conſtricted into the triangular ſhape, and takes the form and peculiarities of a vein. From this foramen, common to the temporal and occipital bone, the jugular vein deſcends obliquely forward and downward, becoming from its deep ſituation ſomewhat more ſuperficial, but in all its extent protected by the ſterno-cleido-maſtoideus muſcle; and it paſſes under the omo-hyoideus muſcle. The internal jugular vein is very irregular in its form; being ſometimes much contracted under the angle of the jaw; bulging and much enlarged, or rather capable of being much diſtended in the middle of the neck; and again contracted before it joins the ſubclaveans. The carotid artery, the internal jugular vein, and the par vagum lie together in the ſame ſheath of looſe cellular membrane.

The internal jugular vein receives theſe communications and branches; behind the angle of the lower jaw, a branch of communication, generally goes down from the poſterior facial vein, and often it is joined by the internal maxillary vein: under the jaw, it either forms free communications with the beginning of the external jugular vein, or it receives the ranine and guttural veins; at all events, there is a branch from the ſide of the throat, and the muſcles of the os hyoides which paſſes into the internal jugular vein. From under the back part of the maſtoideus muſcle, it receives branches from the occipital veins, and forms communications with the vertebral veins: near its termination the great jugular vein receives the guttural and lower thyroid veins.

Of the vertebral veins.—There is difficulty in aſſigning origins to theſe veins, for they are rather like a chain of communication; they run in the holes of the tranſverſe apophyſis of the cervical vertebræ, and ſurround the proceſſes with areolæ. Firſt a communication is formed with the great lateral ſinus, then they receive the flat ſinuſes from under the dura mater, covering the cuniform proceſs of the occipital bone, (the baſilar ſinuſes) and as they deſcend they form tranſverſe communications, which receive the branches of that chain of inoſculations, which runs down upon the ſpinal marrow. The vertebral veins, in their deſcent, ſend out diviſions which run down upon the outſide of the canal, and receive branches of veins from the muſcles on the fore part of the vertebræ, and ſome of the proper cervical veins from behind. The *vena cervicalis* coming from the ſide of the neck, unites with the vertebral vein near its termination, in the back part of the ſubclavean, or ſometimes in the axillary vein.

SECTION II.

OF THE VEINS OF THE ARM.

THE veins of the arm are in two ſets, the venæ comites; and the external or ſubcutaneous veins, being thoſe without the faſcia, and not ſubject to the compreſſion of the muſcles. Of theſe, the latter are the more important and require a particular deſcription.

On the palm of the hand, the veins are few and ſmall, becauſe they are there ſubject to compreſſion in the frequent graſping of the hand; but on the back of the hands and fingers, the veins are numerous and large. The veins creeping along the fingers, make a remarkable inoſculation on the back of the firſt phalanges, and then paſſing in the interſtices of the knuckles, form a great and irregular plexus on the back of the hand *: the principal branch of which ſometimes takes the form of an arch †.

The plexus of veins from the back of the hand is continued over the back of the wriſt: when ſome of the larger branches, after playing over the heads of the radius and ulna, take a courſe, the one on the lower, and the other over the upper edge of the arm, whilſt the back of the arm is left without any remarkable veins taking their courſe there.

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* *Plexus dorſalis manus.*

† *Arcus venoſus dorſalis.*

The veins on the back of the hand have nerves intermingling with them, viz. branches of the ulnar nerve, and the extreme branches of the muſcular ſpiral nerve: ſo that it is a great miſtake to ſuppoſe that bleeding in the back of the hand might be ſubſtituted with advantage for the common operation in the bend of the arm.

VENA CEPHALICA.—The vein of the back of the thumb running into a trunk, which takes a courſe over the outſide of the wriſt, is called CEPHALICA POLLICIS.

From this vein and the diviſion of the plexus of the back of the hand, a conſiderable trunk is generally formed, which takes its courſe on the radial edge of the arm, and is called CEPHALICA MINOR, or RADIALIS EXTERNA. This vein in its tract over the extenſor radialis, and the ſupinator longus, has many lateral communications, particularly with the median vein.

This vein, now joined by the median cephalic, and riſing upon the outſide of the humerus, is the great cephalic vein; and it paſſes, firſt betwixt the biceps and triceps brachii, and then betwixt the deltoides and pectoralis major muſcles. Several ſmall cutaneous veins play over the belly of the biceps muſcle, and communicate with the baſilic vein; a little below the external condyle of the os humeri, the cephalic vein detaches a branch which aſcends betwixt the brachialis internus and ſupinator longus, and which afterwards forms inoſculations with the baſilic vein, on the back of the arm.

The great cephalic vein paſſing up betwixt the tendons of the pectoralis major and the deltoid muſcles, ſinks into the axilla and joins the axillary vein. The LESSER CEPHALIC is a vein which runs up betwixt the pectoral and deltoid muſcles, and ſinks generally into the ſubclavean vein: ſometimes it joins the external jugular vein.

VENA BASILICA*. We trace the origin of the baſilic vein from thoſe veins which, being continued from the plexus, on the back of the hand, take their courſe over the lower head of the ulna. (A conſpicuous branch of theſe veins, from the little finger, was called *ſalvatella* by the ancients). From this origin, the baſilic vein takes a ſpiral courſe on the ulnar edge of the fore arm, ſometimes in one great trunk, oftener in two, ſometimes in a plexus of veins; here it may be called ULNARIS SUPERFICIALIS, OF CUBITALIS INTERNA. This vein, now riſing before the inner condyle of the humerus, paſſes on the inner margin of the biceps flexor muſcle; here it forms very free and numerous connections with the internal or bracheal vein; the ſatellites and cephalica, now paſſing up, until it ſinks under the tendon of the pectoral muſcle, it joins the axillary vein.

The great baſilic vein, or the great trunk, after it has aſcended above the elbow, and received the median baſilic, is joined by ſeveral deep branches of veins, as thoſe which accompany the bracheal artery, called ſatellites or comites, a vein which is called profunda brachii; and ſtill nearer its determination, it receives the addition of the *vena ſubhumeralis* or *articularis*, and the *venæ ſcapulares*, viz. thoſe anſwering to the arteries of that name.

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* Brachialis. The ancients termed the baſilic vein of the right arm, the vein of the liver, or vena hepatica brachii, and that of the left, the vena ſplenica brachii.

VENA MEDIANA MAJOR *.—This is a vein which runs up the middle of the fore arm, beginning from the plexus of veins, which play over the flexor tendons, and come from the ball of the thumb; it is a vein which is very irregular, being ſometimes double, and ſometimes rather in the form of a plexus, than to be conſidered as a regular trunk; often it is particularly ſhort, and can be conſidered as a trunk, only for a few inches as it approaches the bend of the arm; not unfrequently it is intirely wanting, and as if annihilated by the preponderance of the branches of the cephalic or baſilic vein. But to take the more common courſe, as an example, when it has aſcended on the middle of the fore arm, near to the bend of the arm it divides; one branch paſſes obliquely outward, and joins the cephalic vein, the other inwards and unites with the baſilic vein; the firſt, is of courſe the MEDIAN CEPHALIC VEIN, the ſecond, the MEDIAN BASILIC VEIN.

Theſe are the two branches which the ſurgeon moſt commonly ſelects for bleeding. Around the median cephalic, the cutaneous nerves play more profuſely, and under the median baſilic vein the humeral artery paſſes. It is by the aukward plunging of the lancet into the median baſilic, that the country bleeder ſo frequently produces the aneuriſm of the artery; but the dreadful ſymptoms following the pricking of the nerve, are more frequently produced by bleeding in the median cephalic; caſes however occur of the pricking of the nerves, while bleeding in the median baſilic vein.

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* *Vena Media, vena ſuperficialis communis.*

AXILLARY VEIN.—The trunk of the veins of the arm paſſes through the axilla, until it arrives betwixt the firſt rib and clavicle, under the name of axillaris. Here lying by the ſide of the artery, it receives many muſcular branches from the fleſh of the ſhoulder, the external and internal ſcapular veins, and the thoracic veins; in general where it paſſes by the head of the humerus it receives the cephalic vein.

SUBCLAVEAN VEINS.—The axillary vein continuing its progreſs over the firſt rib, becomes the ſubclavean vein: on the right ſide the vein is ſhorter, and deſcends more obliquely; on the left it is longer, of courſe leſs oblique, but ſtill its direction is downward; paſſing before the trachea, and the branches of the arch of the aorta, it joins the ſubclavean of the right ſide, and together they form the ſuperior cava: the ſubclavean vein receives theſe veins, a vein from the ſhoulder and lower part of the neck, the vertebral vein, with ſome leſſer plexus of veins deſcending from the neck, the internal jugular vein (and in the angle of the union of theſe the thoracic duct), and laſtly the thyroid veins. From below they receive the leſſer internal thoracic veins.

SECTION III.

THE SUPERIOR VENA CAVA, THE VENA AZYGOS, AND LESSER VEINS OF THE THORAX.

THE ſuperior vena cava is the trunk of all the veins of the head, neck, arms, and of the parts in the thorax; ſoon after it is formed by the ſubclavean veins, it is joined by the vena azygos, and receiving the INTERNAL MAMMARY VEINS and the VENÆ THYMICÆ and PERICARDIAC branches, the INTERCOSTAL and BRONCHIAL veins, it deſcends into the pericardium, and dilates or opens into the right ſinus or auricle.

VENA AZYGOS*. This is the principal vein of the thorax, and chiefly of the walls of the thorax. It is obſerved to take its origin upon the vertebræ of the loins from ſome of the lumbar veins, or by inoſculations with the renal ſpermatic or leſſer branches of the abdominal cava, receiving the firſt and ſecond lumbar veins, as in its aſcent in the thorax, it receives the intercoſtal veins on either ſide †; aſcending betwixt the crura of the diaphragm, and by the ſide of the aorta, it ſometimes receives the lower phrenic veins; in the thorax lying on the right ſide of the bodies of the vertebræ, and before the intercoſtal arteries, it receives the bronchial veins from the root of the lungs, and from the trachea it receives the veins of the poſterior mediaſtinum and œſophagus; through the intercoſtal veins, it communicates with the external and internal mammary veins, and with the venal circles of the ſpinal marrow.

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* Sine pari.

† We except ſome of the veins from the interſtices of the higher ribs, particularly on the right ſide, which enter the ſubclavean vein.

Upon the third vertebra, the azygos vein ſeparates from the ſpine, and with an arch, and bending round the root of the lungs, it opens into the ſuperior cava, juſt where it is about to enter the pericardium: where it opens into the great vein, it is guarded by a valve.

This vein however, like moſt others, has conſiderable variety, and does not always merit the name of azygos, for ſometimes it is double, a diviſion aſcending on the left ſide of the ſpine, and uniting with the branch of the other ſide, juſt as it is about to enter into the ſuperior cava.

OF THE LESSER VEINS IN THE THORAX.—The VENÆ MAMMARIÆ take a courſe by the ſide of the internal mammary artery, and require no deſcription. Like the arteries, they ſpread their branches on the muſcles of the belly, and communicate with the diaphragmatic and lumbar and epigaſtric veins. The left mammary vein terminates in the left ſubclavean vein, the right in the ſuperior vena cava.

THE VENÆ THYMICÆ enter, either into the union of the ſubclavean veins, or they enter into the guttural veins, or the internal mammary veins.

THE PERICARDIAC VEINS gather their branches from the pericardium, from the aorta, trachea and lymphatic glands; they ſend down branches by the ſide of the phrenic nerve, which inoſculate with the veins of the diaphragm; they enter the internal mammary vein, or the ſuperior cava, or the terminations of the right ſubclavean.

THE SUPERIOR INTERCOSTAL VEINS.—The right and left intercoſtal veins differ in their ſize and diſtribution; the right is ſmall, and receives only one or two of the upper intercoſtal veins, which do not enter into the azygos vein. The vein of the left ſide begins even ſo low as the interſtice of the ſeventh rib; it receives branches from the pleura, pericardium and lungs (viz. the broncheal veins) and from the œſophagus; they enter the ſubclavean veins.

CHAP. II.

OF THE VEINS WHICH UNITE TO FORM THE INFERIOR VENA CAVA.

THE inferior vena cava receives the veins of the lower extremities, the hypogaſtric and abdominal veins, and the veins of the viſcera of the abdomen; but thoſe of the membraneous contents of the abdomen are received by it only indirectly, and through the circulation of the liver.

OF THE VEINS OF THE LEG AND THIGH.

WE have obſerved that the veins of the extremities are in two ſets; the deep and ſuperficial. In the leg and thigh the deep-ſeated veins accompany the arteries, and receive the ſame name: the cutaneous veins are the ſaphena major and minor.

SAPHENA MAJOR*.—A large and beautiful plexus of veins is formed on the fore part of the foot, and coming from the back of the toes, and outſide of the foot. Two principal veins ariſe from the arch which theſe form: one takes the courſe behind the inner ancle, and is the ſaphena major; the other paſſes over the outer ancle, and forms the ſaphena minor.

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* *Saphena magna, interna.*

The great ſaphena may be traced from the great toe, from the inſide of the foot, and behind the ancle: it receives one or two branches from the ſole of the foot. Sometimes the principal branch paſſes behind the lower head of the tibia, ſometimes before it, or it forms circles here: a little above the ancle a vein from the middle of the metatarſal arch comes obliquely over the tendon of the tibialis anticus and joins it.

The ſaphena, now a conſiderable trunk, runs up the leg before the inner margin of the belly of the gaſtrocnemius muſcle, and on the inner ridge of the tibia. In this courſe it receives numerous cutaneous branches, and backward, over the belly of the muſcles, it forms inoſculations with the leſſer ſaphena. From the inſide of the leg the trunk aſcends on the inſide of the knee, where it receives ſeveral branches, coming round the joint, and over the head of the tibia. Now paſſing ſomewhat obliquely, it aſcends upon the thigh, and, at the ſame time, turns from the inſide to the fore part of the thigh. In the thigh the great ſaphena receives many branches, and is not always a ſingle vein: for ſometimes the branches collecting form a ſmall trunk, running collateral to the greater vein, and which joins it in the groin. In all this courſe the ſaphena vein is ſuperficial and lies imbedded in the cutaneous fat; with but a very ſlight and imperfect apponeuroſis incloſing it; while it is external to the proper faſcia of the leg and thigh. As it aſcends upon the thigh, however, it does not dive ſuddenly under the faſcia; but is gradually enveloped and embraced by the condenſed cellular membrane and faſcia.

When it was more the practice than at preſent to bleed in the ancle, the ſaphena major was the vein ſelected: but as in all the courſe of the vein, from the great toe to the knee, it is connected with the nerve which bears its name, there are not wanting inſtances of thoſe bad effects from pricking of the nerve, which not unfrequently follow the bleeding in the arm.

SAPHENA MINOR*. This vein ariſes from the plexus on the outſide of the dorſum pedis: it runs over the outer ancle and above the faſcia, covering the tendons of the peronei muſcles. Here receiving many branches and forming frequent deep inoſculations, it mounts on the outſide of the vagina or faſcia, which covers the back of the leg, until arriving betwixt the hamſtring tendons it ſinks into the popliteal hollow, terminating in the popliteal vein.

The other veins of the lower extremity which accompany the arteries in their courſe, need little deſcription.

ANTERIOR TIBIAL VEIN.—The veins accompanying the anterior tibial artery form many inoſculations, and when minutely injected, almoſt conceal the artery. They are the anterior tibial veins and only unite into a trunk, where perforating the interoſſeous ligament it joins the popliteal vein.

POSTERIOR TIBIAL VEIN.—In the ſole of the foot we have the external and internal plantar veins, which uniting into trunks, accompany the artery behind the inner ancle. In its courſe betwixt the ſoleus and the tibialis anticus muſcles, it cannot be called the poſterior tibial vein; for it is a mere net-work of veins ſurrounding the poſterior tibial artery. It receives, near its termination, a branch called SURALIS, from the gaſtrocnemii and ſoleus: it terminates in the popliteal vein.

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* *Vena ſaphena parva, externa.*

THE VENÆ PERONEÆ are the venæ comites by the tibial artery, and are two or three in number. All theſe veins have free inoſculations with each other.

THE POPLITEAL VEIN.—This vein is formed by the three diviſions of deep veins accompanying the arteries of the leg, and the ſaphena minor. It lies more ſuperficial than the artery, and ſeems to cling round it. As it aſcends, however, it twiſts round the artery, the artery being neareſt the bone—a little above the joint it receives the leſſer ſaphena.

This vein, perforating the tendon of the triceps, comes to the fore part of the thigh, ſtill united to the artery: it is now the CRURAL VEIN. As it aſcends it gets from behind the artery, ſo that in the groin it lies nearer the pubes than the artery does: oppoſite the trochanter minor it receives the internal and external circumflex veins, and the PROFUNDA FEMORIS. About an inch below Powpart's ligament the crural vein receives the ſaphena major, and the ſmall external pudic veins.

EXTERNAL ILIAC VEIN.—The femoral vein lying on the inſide of the artery or nearer the pubis, enters the abdomen under the femoral ligament, and paſſing by the ſide of the Pſoas muſcle becomes the external iliac vein. It receives ſeveral leſſer veins juſt within the ligament particularly the epigaſtric vein from the muſcles and integuments of the belly, and the veins accompanying the arteria circumflexa ilii. The external iliac vein is joined by the HYPOGASTRIC VEIN which aſcends from the pelvis. It requires no minute deſcription; it anſwers to the diſtribution of the hypogaſtric artery. This which is the internal iliac joining the trunk from the thigh forms the COMMON ILIAC VEIN.

VENA CAVA ABDOMINALIS *.—A little lower than the bifurcation of the aorta, the right and left common iliac veins unite. By this union they form the vena cava. This vein aſcends upon the right of the aorta. It receives fewer branches than would naturally be imagined, becauſe the veins of the viſcera take their courſe by the porta into the liver. It receives the lumbar veins the ſpermatic veins, the renal, ſuper-renal, and phrenic, veins. Paſſing upward it is received into its appropriate foſſa in the liver, and ſeceding a little from the ſpine it receives the VENÆ CAVÆ HEPATICÆ and perforates the diaphragm; entering the pericardium it expands into the great ſinus, or right auricle of the heart.

RENAL VEINS†.—Theſe veins are leſs irregular than the arteries of the kidney, which relation of the veins and arteries is uncommon. From the relative ſituation of the kidneys to the cava it is evident that the right vein muſt be ſhort; the left comparatively longer and taking a courſe from the kidney over the aorta ‡.

SUPRA-RENAL VEINS.—Theſe little veins are like the arteries in their courſe. The right one enters ſome-

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* *Vena Cava inferior.*

† Emulgent veins.

‡ The Renal veins however ſometimes vary in their number, the right being double or triple, the left even ſometimes in four branches.

times into the vena cava, ſometimes into the renal vein. The left ſometimes receives the phrenic vein of that ſide and enters into the renal vein.

Spermatic veins.—Of the general diſtribution of theſe veins nothing need be ſaid, after looking to the deſcription of the arteries *.

The Vena Portæ has been already deſcribed in the ſecond volume.

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* See p. 189.

OF THE TEETH.

There is naturally an inclination in the author of a ſyſtem to amplify ſome particular ſubjects, and to abridge, or beſtow leſs attention, on others which may to him appear leſs intereſting or curious. To reſtrain this tendency has been the moſt irkſome taſk which I have felt in completing the preſent work. The growth and ſtructure of the teeth forms an elegant and intereſting ſubject of enquiry; and it is difficult to concentrate the view of it ſo as to be conſiſtent with the arrangement of a ſyſtematic work.

As the general nature and uſe of the teeth are ſufficiently underſtood, there can be little objection to our beginning the preſent ſubject with conſidering the ſtructure of the human teeth.

Of the structure of the teeth.

A tooth conſiſts of theſe parts.—In the firſt place, the enamel, a peculiarly hard layer of matter compoſing the ſurface of the body of the tooth. The internal part, body, or ſubſtance of the tooth, is leſs ſtoney and hard than the enamel, but of a firmer ſtructure and more compact than common bone. In regard to the form of the tooth, we may obſerve that it is divided into the crown, neck, and fangs, or roots of the tooth, which go deep into the jaw. There is a cavity in the body of the tooth, and the tube of the fangs communicates with it. This cavity receives veſſels for ſupplying the remains of that ſubſtance upon which the tooth was originally formed. The roots of the teeth are received into the jaw by that kind of articulation which was called gomphoſis. They are not firmly wedged into the bone, for, in conſequence of maceration, and the deſtruction of the ſoft parts, the teeth drop from the ſcull. There is betwixt the tooth and its ſocket in the jaw a common perioſteum.

Of the enamel. The ſurface of a tooth, that which appears above the gum, is covered with a very denſe hard layer of matter, which has been called the enamel. In this term there is ſome degree of impropriety, as aſſimilating an animal production with a vitreous ſubſtance, although the enamel very widely differs from the glaſſy fracture when broken. This matter beſtows the moſt eſſential quality of hardneſs on the teeth; but it is probably uſeful in another way, being intermediate betwixt the central bony part of the tooth, which has life, and is ſubject to diſeaſe, and matter altogether foreign to the living body. When the enamel is broken off, and the body of the tooth expoſed, it quickly decays.

The enamel is the hardeſt production of the animal body. It ſtrikes fire with ſteel: in church-yard ſculls it is obſerved to reſiſt decay when the centre of the tooth has fallen into duſt. It has been found that the component parts of the enamel are nearly the ſame with thoſe of bone: in bone the phoſphate of lime is depoſited on the membranes, or cartilage, but this hardening matter of bones is a ſecretion from the veſſels of the part, and is accumulated around the veſſels themſelves: it is ſtill within the controul of their action, and is ſuffering the ſucceſſion of changes peculiar to a living part. But, in the enamel, the phoſphate of lime has been depoſited in union with a portion of animal gluten, and has no vaſcularity, nor does it ſuffer any change from the influence of the living ſyſtem. Although the hardening matter be principally phoſphate of lime, a ſmall proportion of the carbonate of lime enters into the compoſition both of bone and of enamel.

Although we call the earthy depoſit the hardening matter, yet it is the union of the glutinous matter which beſtows the extreme hardneſs, for, when the tooth is as yet within the jaw, and in an early ſtage of its formation, the depoſition is ſoft, and its ſurface rough; but, by a change in the ſurface, which throws out this ſecretion, the firſt depoſition is penetrated with gelatinous ſecretion, which, either by this penetration ſimply, or by cauſing a new appoſition of its parts, (its ſtructure indeed looks like chryſtallization,) beſtows the denſity and extreme hardneſs on this cruſt. When an animal is fed with madder, the colouring matter coming, in the courſe of the circulation, in contact with the earth of bone, is attracted by it, and is depoſited upon it in a beautiful red colour. This colouring matter penetrates more than injection can be made to do in the dead body; and, as by this proceſs of feeding, the enamel is not tinged, we have a convincing proof that the vaſcular ſyſtem has no operation on the enamel after it is formed.

From the compoſition of the enamel, we muſt be aware of the baneful effects of acidulated waſhes and powders to the teeth: they diſſolve the ſurface, and give a deceitful whiteneſs to the teeth; they erode the ſurface, which it is not in the conſtitution of the part to reſtore.

OF THE CENTRAL BONY PART OF THE TOOTH. The chemical compoſition, and the manner of combination of the matter forming the central part of the tooth, and of the fangs, is ſimilar to the other bones of the body; but when we examine the hardneſs and the denſity of the tooth, and ſee that it is not even porous, or apparently capable of giving paſſage to veſſels, we doubt of its vaſcularity, and are apt to ſuppoſe that it holds its connection with the living jaw-bone by ſome other tenor than that of veſſels, and the circulation of the blood through it. I muſt acknowledge that the difficulty in deciding on the vaſcularity, and degree of vitality which the teeth poſſeſs, appears to me ſo great, that I ſhall at preſent venture to give no decided opinion. The vaſcularity of the perioſteum, which ſurrounds the teeth and veſſels which enter by the fangs to the cavity of the teeth, ſeemed to ſhew a ſedulous care to ſupply the tooth plentifully with blood. As this part of the tooth has often been coloured by feeding young animals with madder, the reverſe of that experiment, which convinces us there is no circulation in the enamel, ſhould ſatisfy us that there is blood circulating through the body of the tooth, and that it undergoes the ſame changes by abſorption which the other bones are proved to do; but theſe experiments may have been made while the teeth were forming by the depoſition from the pulp, and of courſe they might be coloured without the experiment affording a fair proof that the circulation continues in the tooth after it is formed. If it be proved that the adult teeth, or a fully formed tooth yet within the jaw, are uniformly tinged with the madder, we muſt without reſerve conclude, that the economy of the teeth is in all reſpects like that of the common bones.

The teeth undergo changes of colour in the living body, to which it would appear they could not be liable as dead matter. They become yellow, tranſparent, and brittle with old age; and when a tooth has been knocked from its ſocket, and replaced, dentiſts have obſerved that it loſes its whiteneſs, and aſſumes a darker hue.

The abſorption of the roots in conſequence of the caries of the body of the tooth, and the abſorption of the fangs of the deciduous teeth, are further alleged in proof of their vaſcularity; not only the preſſure of the riſing tooth on the fangs of the temporary teeth will cauſe an abſorption of the latter, but the fangs of the temporary teeth will waſte and be abſorbed, ſo as to drop out without the mechanical preſſure of the permanent teeth, and before they have advanced to be in contact with the former.

The teeth ſeem acutely ſenſible, but a little conſideration teaches us that the hard ſubſtance of the teeth is not endowed with ſenſibility, and that it muſt be the remains of the vaſcular pulp, preſently to be deſcribed, occupying the centre of the tooth, which being ſupplied with nerves, gives the acute pain in tooth-ach It is as a medium communicating or abſtracting heat, that the tooth itſelf ſeems to give pain. When wrought upon by the dentiſt, no ſenſation is produced unleſs the tremor be communicated to the jaw, or unleſs the abrading, or cutting inſtruments, be ſo plied as to heat the tooth; then an acute pain is produced from the heat communicated to the centre; and ſo, extremely cold ſubſtances, or liquids, taken into the mouth, ſtill produce pain, from the cold affecting the pulp of the tooth.

As living parts, the teeth have adheſion to the perioſteum, and are connected with their internal pulp; but when they ſpoil, and are eroded, the diſeaſe ſpreads inwardly, probably deſtroying the life of the bony part of the tooth, the progreſs of which diſeaſe is marked by a change of colour penetrating beyond the caries towards the centre of the tooth. When this diſcolouration has reached the internal ſurface, the pain of tooth-ach is excited, the pulp, vaſcular and ſupplied with nerves, inflames, from a want of accordance with the altered ſtate of the tooth, juſt as the dead ſurface of a bone will inflame the central perioſteum and marrow. The extreme pain produced by this ſtate of the tooth probably proceeds from the delicate and ſenſible pulp ſwelling in the confinement of the cavity of the tooth.

In caries of the teeth, the body of the tooth is diſcovered deep in its ſubſtance long before the pulp of the central cavity is expoſed by the progreſs of the caries. No exfoliation, or exoſtoſis, takes place upon that part of the tooth which is above the gum, which may be owing to the mere compactneſs of the oſſific depoſitions, for we know that the bones of greateſt denſity are the moſt apt to yield altogether to diſeaſed action, and die, inſtead of throwing off their ſurface, in exfoliations, or taking any other variety of diſeaſed action.

In the further conſideration of this ſubject, there are circumſtances which will make us doubt of there being vaſcular action in the teeth, and perhaps incline us to believe that they poſſeſs a lower degree of life, and are leſs ſubject to change than other parts. Suppoſing the bony part of the tooth to be vaſcular, and to poſſeſs the principle of life, is not the firm adheſion and contact of the enamel to the body of the tooth a curious inſtance of a part deſtitute of life adhering to the ſurface of a living part, without producing the common effects of excitement and exfoliation, or inflammation, in the latter? Is the enamel, though not a vaſcular part, poſſeſſed of ſome quality which diſtinguiſhes it from foreign matter, or is the bony part of the tooth poſſeſſed of ſo low a degree of vaſcular action, that it is not excited by the contact and adherence of the enamel? We muſt ſuppoſe that ſome accordance ſubſiſts between them from what is obſerved to be the effect of the loſs of the enamel, for then the bone of the tooth ſpoils rapidly, and becomes carious.

In rickets, and molities oſſium, and other diſeaſes of debility in which the body waſtes, or the growth is retarded, the growth of the teeth is not retarded in the one caſe, nor is the grown teeth altered in their form or properties in the other. This appears to me to ſupport the idea of there being a diſtinction in the economy between the manner of the formation of the teeth, and of common bone. The effects which we perceive in the bony ſyſtem under theſe diſeaſes, are produced by a preponderance of the abſorbents over the activity of the ſecreting veſſels; while in the teeth no ſuch effect can take place if they are formed by a depoſition of bony matter which is not re-abſorbed, nor undergoes the revolution of depoſition and re-abſorption, as in other parts of the body is the caſe. Accordingly we find in rickets, and the molities oſſium, where the hardeſt bone yields, where the jaw-bone itſelf is diſtorted or altered in its form, that the teeth remain diſtinguiſhed for their ſize and beauty; and in rickets the teeth are large, and perfectly formed, while the jaws are ſtinted and interrupted in their growth. The conſequence of this is, that the teeth form a larger range than the jaw, and give a characteriſtic protuberance to the mouth.

The roots of the teeth are ſometimes found enlarged, diſtorted, or with exoſtoſis formed upon them. Again the cavity of the tooth is found to have been filled up with the formation of new matter, or around the fangs we often find a ſmall ſac of pus, which is ſometimes drawn out in extracting the tooth. Nevertheleſs, in theſe examples of diſeaſe, there are no unequivocal marks of vaſcular action in the teeth; the unuſual form, or exoſtoſis of the roots, is produced by an original defect in the formation. The filling up of the cavity of the tooth is cauſed by the reſumed oſſific action of the pulp in conſequence of the diſeaſe and deſtruction of the body of the tooth; and the abſceſſes which ſurround the fangs are cauſed by the death of the tooth, in conſequence of which it has loſt its ſympathy with the ſurrounding living parts, and becomes a ſource of irritation like any other foreign body.

We muſt conclude, that the whole phenomena diſplayed in the formation, adheſion, and diſeaſes of the teeth, ſhow them to be poſſeſſed of life, and that they have a correſpondence, or ſympathy with the ſurrounding parts. But are we prepared to acquieſce in the opinion of Mr. Hunter, that they poſſeſs vitality while yet they have no vaſcular action within them? We naturally ſay, how can ſuch vitality exiſt independently of a circulation? But there are not wanting examples of an obſcure and low degree of life exiſting in animals' ova, or ſeeds, for ſeaſons without a circulation; and if for ſeaſons, why not for a term of life? We never obſerve the animal economy providing ſuperfluouſly, and ſince there is no inſtance to be obſerved in which the teeth have ſhown a power of renovation, why ſhould they be poſſeſſed of vaſcularity and action to no uſeful end? All that ſeems neceſſary to them is, that they ſhould firmly adhere without acting as a foreign and extraneous body to the ſurrounding parts, and this, vitality without vaſcular action, ſeems calculated to provide.

OF THE FORMATION AND GROWTH OF THE TEETH.

In the jaws of a child newly born, there are contained two ſet of teeth as it were in embrio: the deciduous, temporary, or milk teeth; and the permanent teeth. The neceſſity for this double ſet of teeth evidently is to be found in the incapacity of alteration of ſhape or ſize in the teeth as in other parts of the body; the ſmaller teeth, which riſe firſt, and are adapted to the curve and ſize of the jaw-bone of an infant, require to be ſucceeded by others, larger, ſtronger, and carrying their roots deeper in the jaw.

Each tooth is formed in a little ſac, which lies betwixt the plates of bone that form the jaw-bone of the fœtus, or child, under the vaſcular gum, and connected with it.

When we open one of theſe ſacs at an early period of the formation of the tooth, a very curious appearance preſents itſelf: A little ſhell of bone is ſeen within the ſac, but no enamel is yet formed. Upon raiſing the ſhell of bone, which is of the ſhape of the tooth, and is the outer layer of the bony ſubſtance of the tooth, a ſoft vaſcular ſtool, or pulp*, is found to have been the mould on which this outer layer of oſſific matter has been formed; and a further obſervation will lead us to conclude that this bony and central part of the tooth is in the progreſs of being formed by ſucceſſive layers of matter thrown out from the ſurface of this vaſcular pulp; though many have explained the formation of the tooth, by ſuppoſing that the layers of this pulp were ſucceſſively oſſified.

If we now turn our attention to the ſtate of thoſe teeth which we know to be later of riſing above the gum, we ſhall find the oſſification ſtill leſs advanced, and a mere point, or perhaps ſeveral points of the depoſited matter on the top of the pulp.

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* Le noyau, la coque, or le germe de la dent, by the French authors.

The pulp, or vaſcular papilla on which the tooth is formed, has not only this peculiar property of oſſification, but, as the period of revolution advances, where it forms the rudiments of the molares for example, its baſe ſplits ſo as to form the mould of two, three, or four fangs, or roots; for around theſe diviſions of the pulp the oſſific matter is thrown out ſo as to form a tube continued downward from the body of the tooth. Gradually, and by ſucceſſive layers of matter on the inſide of this tube, it becomes a ſtrong root, or fang, and the bony matter has ſo encroached on the cavity, that only a ſmall canal remains, and the appearance of the pulp is quite altered, having ſhrunk in this narrow ſpace.

We have ſaid that the tooth forming on its pulp, or vaſcular bed, is ſurrounded with a membrane giving the whole the appearance of a little ſac. This membrane has alſo an important uſe. It is vaſcular alſo as the pulp is, but it is more connected with the gums, and receives its veſſels from the ſurface, while the pulp, lying under the ſhell of the tooth, receives its blood-veſſels from that branch of the internal maxillary artery which takes its courſe in the jaw.

The enamel is formed after the body of the tooth has conſiderably advanced towards its perfect form. It is formed by a ſecretion from the capſule, or membrane, which inveſts the teeth *, and which is originally continuous with the pulp. The enamel is thicker at the point, and on the body of the tooth, than at its neck. Mr. Hunter ſuppoſed that the capſule always ſecreting,

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* This outer ſac has been called *chorion*, from the numerous veſſels diſtributed upon it. See Heriſſant.

and the upper part of the tooth being formed firſt, it would follow of courſe that the point and body of the tooth would be covered with a thicker depoſition; but it rather appears that the part of the ſac oppoſite to the upper part, and body of the tooth, has a greater power of ſecreting, being in truth more vaſcular and ſpongy, for the whole of the body of the bony part of the tooth is formed before the enamel inveſts the tooth.

We are indebted to M. Heriſſant for much of the explanation of the manner in which the enamel is formed. He deſcribes the ſac *, its attachment to the pulp, and to the neck of the teeth,—as the tooth advances to its perfect form, the ſac alſo changes. At firſt it is delicate and thin, but it thickens apace. And he aſſerts, that if after this progreſs is begun you examine the inner ſurface of it with a glaſs, you will perceive it to be compoſed of little veſicles in regular order, and which ſometimes have a limpid fluid contained in them. This liquid exuded upon the ſurface of the teeth he ſuppoſes to form the enamel. He explains alſo how this ſac, originally inveſting the body and neck of the tooth, being pierced by the edge of the tooth, and the tooth riſing through it, is inverted, and by ſtill keeping its connection with the circle of the crown of the tooth, riſes up in connection with the gum, and in ſome degree forms the new gum which ſurrounds the tooth.

Succeeding authors have found this membrane double. We may examine it moſt ſucceſsfully, ſays Mr. Hunter, in a new-born child, and we find it made up of two lamellæ, an external and an internal; the

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* Reſſemble aſſez à une petite bourſe fermée.

external is ſoft and ſpongy, without any veſſels; the other is much firmer, and extremely vaſcular, its veſſels coming from thoſe that are going to the pulp of the tooth. He adds, that while the tooth is within the gum, there is always a mucilaginous fluid like the ſinovia in the joints between this membrane and the pulp of the tooth.

OF THE GROWTH OF THE SECOND SET OF TEETH, AND THE SHEDDING OF THE FIRST SET.

The firſt, or deciduous ſet of teeth, being adapted only for the jaws of a child, are deſtined to be ſhed, and to give place to the adult, or permanent ſet of teeth. Accordingly, in obſerving the progreſs of the formation of the firſt teeth, the rudiments of the ſecond may alſo be ſeen in the fœtus of the ſeventh or eighth month; and in the fifth and ſixth month after birth, the oſſification begins in them. The rudiments of the permanent teeth may be obſerved even when the ſac is very ſmall, and appear like a filament ſtretching up to the neck of the ſac of the deciduous teeth. Theſe ſacs lie on the inner ſide of the jaw-bone, and when further advanced, the necks of the two ſacs, (both as yet under the gum,) are united; but when the firſt teeth are fully formed, and have riſen above the gum, the alveolar proceſſes have been at the ſame time formed around them, and now the ſac of the permanent teeth have a connection with the gums through a ſmall foramen in the jaw-bone, behind the ſpace through which the firſt teeth have ſhot.

The opinion now entertained, that the ſecond ſet of teeth puſhes out the firſt, is very erroneous, for the change on the deciduous and the growing teeth ſeems to be influenced by laws of coincidence indeed, but not of mechanical action. Sometimes we obſerve the falling tooth waſted at the root, or on the ſide of the fang, by the preſſure of the riſing tooth. Now here we ſhould ſuppoſe that the newly-formed tooth ſhould be the moſt apt to be abſorbed by the preſſure of the root of the deciduous tooth, did we not recollect that the new tooth is inveſted with the hard enamel, while the preſſure on the other acts upon the bony root. But there is more than this in the phenomenon of the ſhedding of the teeth, for often the fang is waſted while the tooth adheres only by the gum, and the permanent tooth has made little progreſs in its elevation, and has not preſſed upon it. This decay and waſting of the fangs of the teeth looks more like a ſatisfactory proof in ſupport of their vaſcularity, than any other change to which they are ſubject.

Yet there ſeems to be no reaſon why we ſhould not ſuppoſe, that as the rudiments of the teeth riſe into action at a particular time, and form the bony centre of the tooth, this formation ſhould be effected by ſimilar laws; that at a particular period the tooth ſhould decay, and that the decay of the tooth ſhould begin with the deſtruction of the fangs. Neither can I reſiſt the belief that the bony part of the tooth has a tendency to diſſolution independently of a circulation of blood through it, or of an internal action of veſſels, and that as the roots waſte, the ſurrounding vaſcular parts abſorb its ſubſtance.

It is no proof of the firſt ſet being puſhed out by the ſecond ſet of teeth, that if the permanent teeth do not riſe, the firſt will remain, their roots unwaſted and firm even to old age; for ſtill I contend that there is an agreement and coincidence betwixt the teeth in their changes, and alſo in the alveoli, by which they are ſurrounded; but this is not produced by the preſſure of the riſing teeth. When a dentiſt ſees a tooth ſeated out of the proper line, and draws it, and finds that he has made the miſtake of extracting the adult tooth, letting the milk tooth remain, he muſt not expect that the milk tooth will keep its place, for the contrary will happen, it will in general fall out.

The old and the new teeth are lodged in diſtinct compartments of the jaw-bone, and what is more curious, their alveoli are diſtinct, for as the roots of the firſt teeth decay, their alveolar proceſſes are abſorbed, while again, as the new teeth riſe from their deep ſeat in the jaw-bone, they are accompanied with new alveoli *; yet theſe alveoli are not ſufficient to ſupport the teeth, for we find that the teeth will remain long perfect while they uniformly retain their relative poſition and number, but when one falls, the reſt more quickly decay; and the chief art of the dentiſt in ſhifting the ſeat of the teeth, is gradually to puſh them along the jaw notwithſtanding theſe bony partitions and proceſſes, ſo as to bring them into equal and ſeemly lines.

No circumſtance can better illuſtrate how perfect the dependence of the alveoli is upon the teeth, than that of their being thrown off with them in extenſive

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* Mr. Hunter.

exfoliations. I have a ſpecimen of this in my collection, where the whole circle of the alveolar proceſſes and teeth is thrown off. This happened after the confluent ſmall-pox. I think I recollect a ſimilar caſe occurring to Dr. Blake. In thoſe tumors which ariſe from the alveoli and gums, filling the mouth with a cancerous maſs, and ſoftening the upper part of the jaw, there is no eradicating the diſeaſe but by taking away the whole adventitious part of the jaw which belongs to the teeth, and leaving only the firmer baſe. But even this operation will be too often unſucceſsful.

When a tooth is loſt, it appears as if the ſpace it occupied were partly filled up by an increaſed thickneſs of the adjacent teeth, and partly by the lengthening of that which is oppoſite: indeed, this appearance has been brought as a proof of the continual growth of teeth. But there is a fallacy in the obſervation; for when the ſpace appears to have become narrow by the approximation of the two adjacent teeth, it is not owing to any increaſe of their breadth, but to their moving from that ſide where they are well ſupported to the other ſide where they are not. For this reaſon they get an inclined direction; and this inclination may be obſerved in ſeveral of the adjoining teeth *.

The tranſplanting of teeth preſents another very intereſting phenomenon. A tooth recently drawn, and placed accurately into a ſocket from which one has been taken, will adhere there: nay, it will even adhere to any living part, as in the comb of a cock. This, however, proves nothing further than what all allow, that the tooth poſſeſſes vitality, for after a time

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* Mr. J. Hunter.

it

it will not adhere; it has become a dead part, and the living ſubſtance refuſes to coaleſce with it. Again, and in oppoſition to this, is it not very extraordinary that the teeth may be burnt by chemical agents, or the actual cautery, down to the centre, and yet retain their hold; or that the body of the tooth may be cut off, and a new tooth fixed into it by a pivot? Had the teeth any vaſcular action, this torturing would cauſe re-action and diſeaſe in them. Sometimes the moſt terrible effects are produced by theſe operations, as tetanus, abceſs in the jaws, &c.; but this happens in conſequence of the central nerve being bruiſed by the wedging of the pivot in the cavity of the tooth, or by the roots of the teeth becoming, as dead bodies, a ſource of irritation to the ſurrounding ſockets.

The diſeaſe produced by the tranſplanting of teeth has not been ſatisfactorily explained, though the inveſtigation would throw conſiderable light on the phyſiology of the teeth, and be in itſelf of practical uſe.

About a month after tranſplanting the tooth, and after it has taken perfect adheſion, the diſeaſe has appeared. An ulceration is perceived in the gum and jaw; or the gum ſhrinking and waſting by ulceration, leaves the tooth and alveoli bare. Soon after, blotches appear on the ſkin; and ſometimes ulcers in the throat. —In ſome caſes, this diſeaſe has been cured without mercury, and in others, ſeems only to have yielded to the mercureal courſe. Mr. Hunter entertained the opinion that it was not venereal, but a diſtinct diſeaſe; and I find that Richter ſuppoſes there are two diſeaſes produced, the one venereal, and the other a peculiar affection. Others have ſuppoſed that this is not a diſeaſe propagated from the one perſon to the other, but produced by the combination of the living principle of two diſtinct ſyſtems! In ſhort, the caſe does not ſeem to be well underſtood. Suppoſing it to be the venereal diſeaſe thus propagated, (and this is the moſt likely ſuggeſtion,) then it does not appear that we ſhould conſider it as an inoculation of the matter of the diſeaſe, but of a part long contaminated, ingrafted: and in this view it will probably be found neceſſary to continue the plan of cure as for an old affection, and not for the recent diſeaſe.

We may conclude that the teeth are peculiar in their ſubſtance and ſtructure, in the manner of their growth and nutrition; and, as they are diſtinct from the other bones of the ſyſtem in their form and connections, ſo are they in their more eſſential qualities.

OF THE GUMS.—The necks of the teeth are ſurrounded by the gums, a red, vaſcular, but firm ſubſtance which covers the alveolar proceſſes. To the bone and to the teeth the gums adhere very ſtrongly, but the edge touching the teeth is looſe. The gums have little ſenſibility in their healthy and ſound ſtate; and by maſtication, when the teeth are loſt, they gain a degree of hardneſs which proves almoſt a ſubſtitute for the teeth. The uſe of the gum is chiefly to give firmneſs to the teeth, and at the ſame time, as Mr. Hunter obſerves, to give them that kind of ſupport which breaks the jar of bony contact. Like the alveolar proceſs, the gums have a ſecret connection with the ſtate of the teeth. Before the milk-teeth appear, there is a firm ridge which runs along the gums,

gums *, but this is thrown off, or waſtes with the riſing of the teeth: and as the teeth riſe the proper gums grow, and embrace them firmly. The gum is firm, and in cloſe adheſion, when the teeth are healthy; looſe, ſpongy, or ſhrunk, when they are diſeaſed. The only means of operating upon the general ſtate of the teeth is through the gums; and by keeping them in a ſtate of healthy action by the bruſh and tinctures, the dentiſt fixes the teeth, and preſerves them healthy; but when they are allowed to be looſe and ſpongy, and ſubject to frequent bleeding, (which is improperly called a ſcorbutic ſtate,) the teeth become looſe, and the gums painful. If a healthy tooth be implanted in the jaw, the gum grows up around it, and adheres to it; but if it be dead or diſeaſed, the gum ulcerates, looſens, and ſhrinks from it; and this ſhrinking of the gums is ſoon followed by the abſorption of the alveoli.

From the diſorder of the teeth, the gums are ſubject to many diſeaſes; ſome of them troubleſome, ſome dangerous, or at leaſt giving riſe to dangerous diſeaſes. They ſwell from tooth-ach and inflammation of the centre of the tooth (parulis), or form tumors from the ſide of the tooth (epulis). Often ſuppuration follows theſe ſwellings; and the matter making its way by the ſide of the jaw, and deſtroying the alveoli, troubleſome fiſtulæ are the conſequence. The accumulation of tartar on the teeth is the cauſe of an ulceration and waſting of the gums, in the end very injurious to the teeth. The ſoft, ſpongy, and bleeding tumors which ariſe from the gums, are in fact diſeaſes of the bone,

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* See Heriſſant.

or

or rather the peculiar characteriſtic of the diſeaſe of the alveoli and of the cancelli of the jaw-bone; and cannot be cured but by a practice which reaches to the root and origin of the diſeaſe.

OF THE FIRST AND SECOND SET OF THE TEETH.

Before we obſerve the claſſing of the adult teeth, we muſt attend to the two ſets of teeth, the infantine or deciduous teeth, and the adult or permanent teeth.

The firſt ſet of teeth are twenty in number: theſe are divided into three claſſes; the INCISORES, four in each jaw; the CUSPIDATI, two in each jaw; and the MOLARES, four in number in each jaw.

The teeth of a child generally appear in this order: firſt the central inciſores of the lower jaw pierce the gum. In a month after, perhaps, their counterparts appear in the upper jaw. Theſe, in a few weeks, are ſucceeded by the lateral inciſores of the lower jaw; then the lateral inciſores of the upper jaw. The growth of the teeth is not after this in a regular progreſſion backwards, for now, inſtead of the cuſpidati, which are immediately lateral to the inciſores, the anterior molares of the lower jaw ſlowly lift their white ſurface above the gum about the fourteenth or fifteenth month. Now the cuſpidati pierce the gum; and, laſtly, the larger molares make their appearance, the teeth of the lower jaw preceding thoſe above. The laſt tooth does not riſe till the beginning of the third year.

The teeth do not always cut the gum in this order; it is only the more regular and common order. When the teeth appear in irregular ſucceſſion, more irritation and pain, and more of thoſe ſymptoms which are uſually attributed to teething, are ſaid to accompany them, an opinion which I believe to have ariſen from ſome caſual obſervations.

The deciduous ſet of teeth terminates with the riſing of the ſecond molaris; for the third molaris being formed about the eighth year, when the jaw is advanced towards its perfect form, is not ſhed, but is truly the firſt permanent tooth. The molares of the adult are properly the permanent teeth (IMMUTABILES), for all the others are deciduous, and are replaced by the adult ſet; yet we muſt recollect that, in oppoſition to Albinus, in this arrangement, it is more common to ſpeak of the whole ſet of the adult teeth as the *immutabiles*.

In the ſixth and ſeventh years the jaws have ſo much enlarged, that the firſt ſet of teeth ſeems too ſmall, ſpaces are left betwixt them, and they begin to fall out, giving place to the adult teeth. But the ſhedding of the teeth is by no means regular in regard to time; the child is already no longer in a ſtate of nature, and a thouſand circumſtances have ſecretly affected the health and growth. The teeth even fall out three years earlier in one child than in another: nay, ſo frequently are ſome of them retained altogether, that it would appear neceſſary to be aſſured of the forward ſtate of the adult tooth before the tooth of the firſt ſet ſhould be thoughtleſsly drawn.

The jaw-bones are ſtill ſo ſmall, that the ſecond ſet of teeth muſt riſe ſlowly and in ſucceſſion, elſe they would be accumulated into too ſmall a circle, and of courſe turned from their proper direction.

The inciſores of the under jaw are looſe commonly when the anterior of the permanent molares are thruſting up the gum. The permanent central inciſores ſoon after appear, and in two or three months thoſe of the upper jaw appear. In three or four months more the lateral inciſores of the lower jaw are looſened, and the permanent teeth appear at the ſame time the anterior molares have appeared. The lateral inciſores of the upper jaw follow next; and, in from ſix to twelve months more, the temporary molares looſen, the long fangs of the cuſpidati retaining their hold ſome time longer.

The anterior molares and the cuſpidati falling, are ſucceeded about the ninth year by the ſecond bicuſpides and the cuſpidati. The poſterior bicuſpides take the place of the poſterior molares about the tenth or eleventh year. The ſecond permanent molares do not appear for five or ſix years from the commencement of the appearance of the permanent teeth. The laſt of the molares, or the dens ſapientiæ, appears from the fifteenth to the twentieth, or even to the twenty-fifth year.

CLASSES OF THE ADULT TEETH.

The teeth at full maturity are thirty-two in number *, and they are divided into theſe claſſes, *inciſores*, *cuſpidati*, *bicuſpidi*, and *molares*.

The inciſores are eight in number, four in each jaw: they are of the ſimpleſt form, their edges are even, and laterally they contract equally to the neck: they are gibbous, forward, and ſlightly concave on the inſide; their roots are ſimple. The inciſores of the upper jaw are larger and ſtronger; thoſe of the lower jaw are ſmaller, neater, and for the moſt part evenly ſet, while the teeth of the upper jaw are more frequently irregular from being crowded together.

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* From twenty-eight to thirty-two in number.—Hunter.

The cuſpidati[†] are four in number, one lateral to the inciſores of each jaw. They are ſtronger than the laſt in their form; thicker at their baſe: in the gum more convex forward, and terminate with a notched central point. In general, and particularly in the lower jaw, they project further than the other teeth; their roots are ſingle and long; they ſtand betwixt the inciſores and grinders in form as in place, for they ſeem neither perfectly adapted to cut like the inciſores, nor for grinding. "We may trace in theſe teeth," ſays Mr. Hunter, "a ſimilarity in ſhape, ſituation, and uſe, from the moſt imperfect carnivorous animal which we believe to be the human ſpecies, to the moſt perfect carnivorous animal, the lion."

Next in order from the ſymphyſis of the jaw riſe the bicuſpides, the fourth and fifth teeth. Theſe are eight in number, and accurately reſemble each other. Taking one, we may obſerve that it is flattened laterally, anſwering to the flat ſide of the root, and that it terminates in two acute points: the internal of theſe points, even when not worn down, is the leaſt. The ſecond bicuſpes is often wanting. The bicuſpides are very often called the anterior grinders. Their roots are ſingle, or appear like two fangs united; or the firſt bicuſpes has in general two ſmall fangs, or is rather

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[*] *Dentes canini,* the eye teeth, from their place of original lodgement in the upper jaw.

forked; the others ſeldom more than one. Their roots are oftener curved than thoſe of the other teeth.

The firſt and ſecond grinders are nearly alike. The body of theſe forms almoſt a ſquare; generally five points project from their grinding ſurface, which makes an irregular cavity in the centre: often ſome leſſer tubercles, or points, are to be obſerved at the baſe of the larger ones. The neck of the tooth is but little contracted. There are two fangs, one foreward, the other backward, with their edges turned outward; their extremities are broad, often bifurcated, and ſhorter than thoſe of the bicuſpides. There are two cavities to each fang leading to the general cavity in the body of the tooth. The fangs at their middle part are generally bent a little backward. The upper grinders have three diverging fangs, and they are more pointed, and have but one canal. They are directly under the floor of the maxillary ſinus.

The jaw acquires its full proportion about the age of eighteen or twenty, when the third molaris, or the *dens ſapientiæ*, makes its appearance. It is ſhorter and ſmaller, and is inclined more inward than the others. Its fangs are leſs regular and diſtinct, being often ſqueezed together. From the cuſpidati to the laſt grinder, the fangs are becoming much ſhorter; and from the firſt inciſor to the laſt grinder, the teeth ſtand leſs out from the ſockets and gums.

FINIS.

ERRATA.

Page	*Line*	
35.	8.	*for* croſſi *read* craſſi
46.	6.	from foot, *for* nerous *r.* nervous
———	———,	— vilous *r.* villous
56.	5.	*for* bourborigmi *r.* borborygmi
81.	20.	— meſſentery *r.* meſentery
83.	3.	— artereal *r.* arterial
84.	penult.	*for* Wipſer *r.* Wepſer
85.	19.	*for* ileac *r.* iliac
—	penult.	*for* hipatica *r.* hepatica
90.	4.	*for* ſegmoid *r.* ſigmoid
92.	8.	— miconium *r.* meconium
93.	11.	— ſegmoid *r.* ſigmoid
—	24.	— ſeminalis *r.* ſeminales
99.	24.	*for* duplication *r.* duplicature
126	15.	— roupes *r.* ropes
138.	12.	— nephretic *r.* nephritic
139.	21.	— naval *r.* navel
142.	14.	— papilla *r.* papellæ
145.	16.	*for* Belini *read* Bellini
146.	5.	— loculentus *r.* luculentus
—	7.	— Belini *r.* Bellini
150.	6.	— meſclus *r.* meſlus
158.	12.	— peroneum *r.* perinæum
162.	7.	— uræcus *r.* urachus
167.	2.	— ſpongeoſum *r.* ſpongioſum
—	4.	*Ibid.*
213.	19.	*for* procedentia *r.* procidentia
220.	7.	— myrteformes *r.* myrtiformes
230.	19.	— Falopean *r.* Fallopean
133.	1.	— cervex *r.* cervix
238.	13.	— veſſicles *r.* veſicles
260.	1.	— chorian *r.* chorion
261.	9.	— cloſſer *r.* cloſer
260.	21.	— gellatinous *r.* gelatinous
272.	7.	— embrioulcia *r.* embryoulcia

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